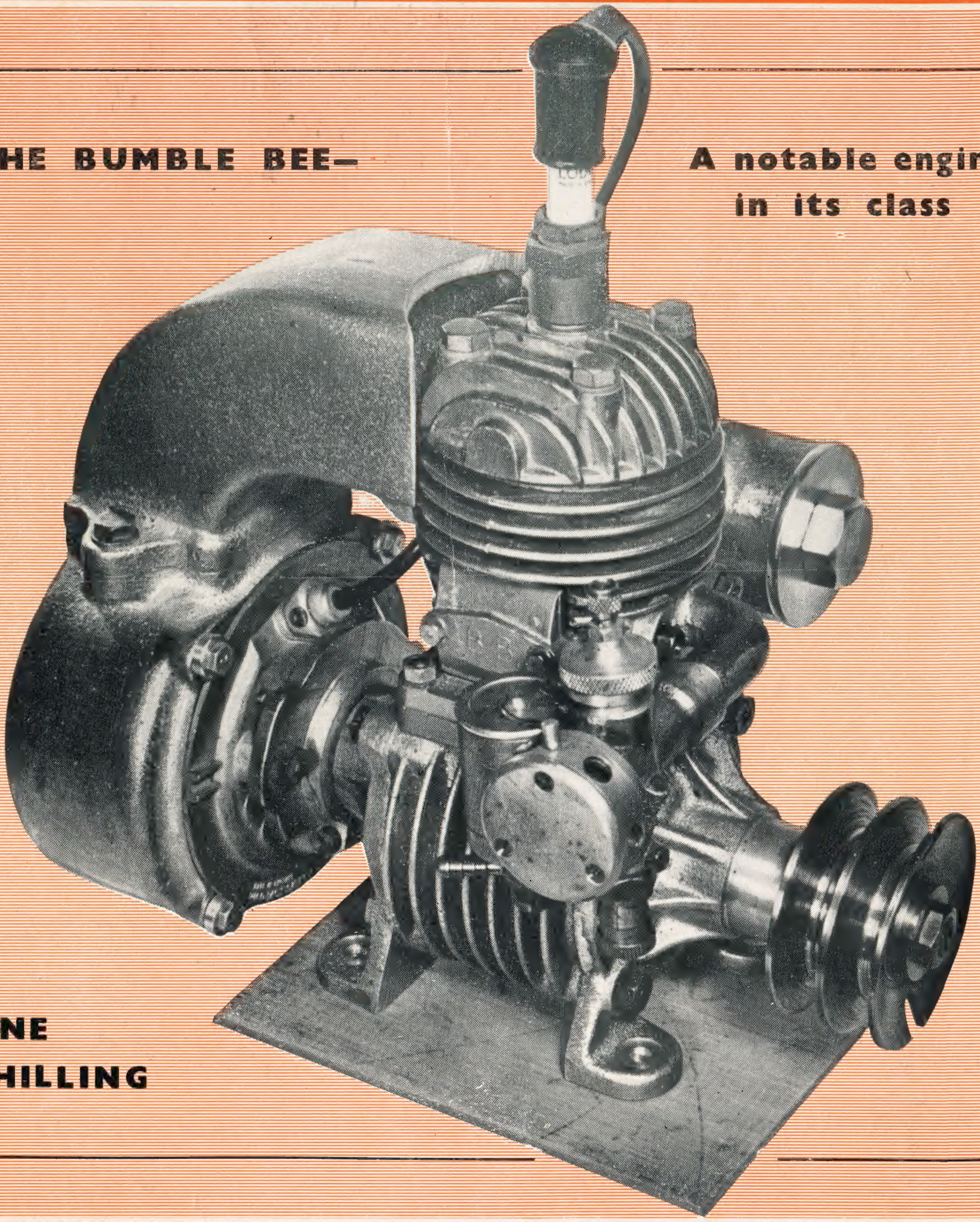
Bittle

# Model Engineer

THE MAGAZINE FOR THE MECHANICALLY MINDED

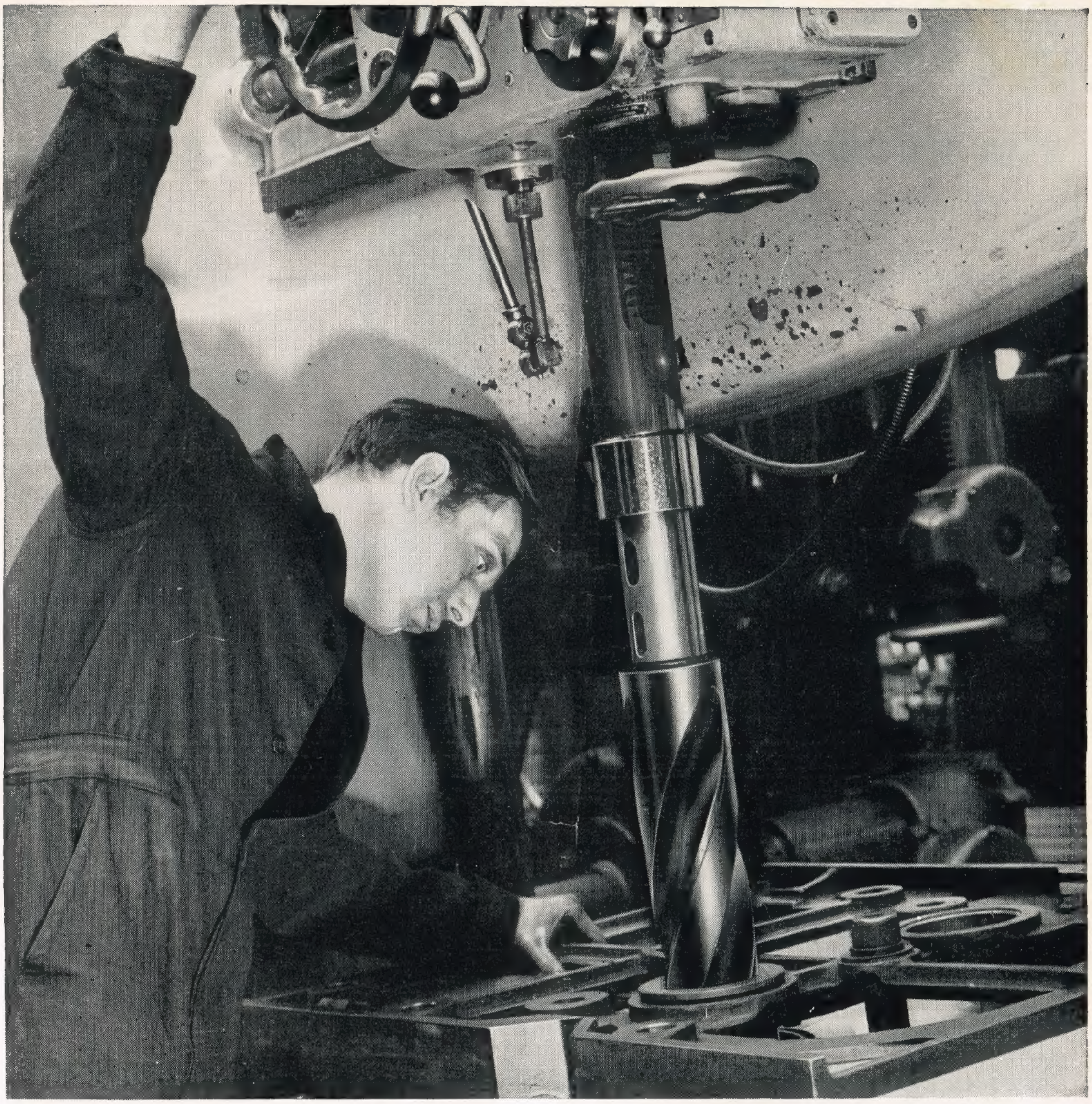
THE BUMBLE BEE—

A notable engine in its class



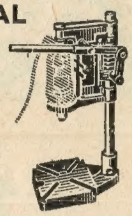
ONE SHILLING

31 JANUARY 1957 VOL 116 NO 2906



# GAMAGES

## 'PICADOR' VERTICAL DRILL STAND



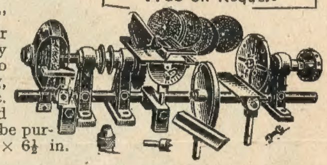
Provides extra leverage, accuracy and control for the famous Home Handyman Electric Drills. "Tee" slotted base. **66/-** *Carr. & Pkg.* 4/-.

**Adaptor for Wolf Cub or Bridges Tool Power drills 2/6 extra.**

No adaptor is required for the Black & Decker drill.

## 'PICADOR' Home Handyman UNIVERSAL LATHE

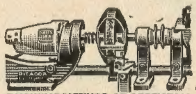
*Tool and Motor Car Accessory List Free on Request*



Can now be powered by any "Wolf Cub," "Black & Decker," "Handy Utility" or "Bridges" Tool Power $\frac{1}{4}$ in. capacity Electric Drill. Robustly constructed to give long trouble-free service. For Turning, Sawing, Sanding, Drilling, Grinding, etc. Fitted with Porous and Graphite impregnated Bronze Brushes. Weight 12 lb. Parts can be purchased separately. Carton size 25 × $6\frac{1}{2}$ × $6\frac{1}{2}$ in. deep, with 24 in. tube bed.

**£6 . 15 . 0** Or 9 Monthly Payments of **16/-**

*Carr. and Pkg. outside our own extensive van area in England and Wales, 7/-; Scotland, 9/9.*



SHOWING METHOD OF ASSEMBLY DRILL TO PUP

**New Electric Drill Cradle** with flexible drive as illustrated on left **23/-** extra. 36 in. Lathe Bed to accommodate the new cradle **2/6** extra. **Electric Drills Extra.**

*SPECIAL NOTE*:—A special adaptor is required for Bridges Electric Drill. **2/-** extra.

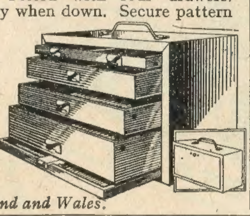
## * The "DO-IT-YOURSELF" SOLDERING KIT


It is the most versatile, simple-to-use kit devised, in fact, a child can use it!! Kit includes Solder Paste, Putty, Tinning Salts (for removing rust and tinning surface in one operation), Valtock Blow Lamp (which take the place of a soldering iron), Brush, Cloth and Glass dish. **27/6** *Post & Pkg.* 1/4.

**VALTOCK BLOW LAMP**

As used in the above Kit. Gives a heat around 2,000° **14/7** *Post & Pkg.* 9*d.*

## HEAVY (18 GAUGE) ALL-STEEL TOOL CABINET



Immensely strong. Fitted with four drawers. Front forms useful tray when down. Secure pattern lock and two keys. Drawer sizes: 15 in. × 7 in. × $2\frac{5}{8}$ in. deep, two each 15 in. × 7 in. × $1\frac{7}{8}$ in. deep—one divided into two compartments, and 15 in. × 7 in. × $\frac{7}{8}$ in.—divided into two compartments. **56/-** Weight $19\frac{1}{2}$ lb. *Carr. & Pkg.* 6/6 *England and Wales.*

## SPIRAL STEEL HIGH SPEED FLUTE REAMERS

First quality U.S.A. make reamers with No. 1 M.T. shank. Set of five comprises $\frac{3}{16}$, $\frac{1}{4}$, $\frac{5}{16}$, $\frac{3}{8}$, and $\frac{1}{2}$ in. BARGAIN PRICE **31/6** *Post & Pkg.* 1/3. SET

**GAMAGES, HOLBORN, LONDON, E.C.1** *HOL 8484* **Open Thursdays until 7 p.m.**

---

**NOTE THE DATE** **ONE DAY ONLY ***

# PRACTICAL POWER TOOL DEMONSTRATION

## SATURDAY — FEBRUARY 2nd — 10 a.m. to 5 p.m.

This is the opportunity you've been waiting for—a chance to see the best in Portable Tools with their fascinating range of attachments—demonstrated by factory trained operators. A chance to put your questions—to handle and get the feel of the very best in the field by all the leading makers. Make a date—make a day of it!

* **IF YOU CANNOT BE WITH US** don't despair. Drop us a line and we will mail you the latest catalogues—quote for your requirements—cash or PERSONAL hire purchase.

**A NEW BOOK** **JUST OUT**

# GETTING STARTED WITH POWER TOOLS

130 PAGES——HUNDREDS OF ILLUSTRATIONS——12 CHAPTERS

This basic elaborately detailed book tells you how to select power tools; how to plan a home workshop; how to apply professional techniques in using the various attachments. 5/9 POST FREE (U.K.)

WE SHALL LOOK FORWARD TO SEEING YOU AT

# T. GARNER & SON LTD

**Hand & Machine Tool Division**

**BARNSLEY**

**6-8, PRIMROSE HILL (Town Centre)** **Phone: 2908**

# Model Engineer

31 JANUARY 1957 VOLUME 116 No. 2906

Subscription 58s. 6d. (U.S.A. and Canada $8.50) post free

Published every Thursday

*Incorporating SHIPS AND SHIP MODELS*


## IN THIS ISSUE



## NEXT WEEK

Trevithick engines in South America

Myrmidon

St Ninian

Workshop topics

Readers' hints

Ship modelling for beginners

Apart from the three articles mentioned, next week's issue of MODEL ENGINEER will contain a great deal of ship-modelling items of interest to all.


All correspondence should be addressed to the Editor, Model Engineer, 19-20 Noel Street, London. W.1.


# SMOKE RINGS

### A WEEKLY COMMENTARY BY VULCAN

ONE pathetic buffer lying between the tracks at Twenty Mile Bridge (there is a large notice there telling you that it is 20 miles to London) formed a rather touching relic of the January train crash near Welwyn Garden City when I passed by there on the following morning.

I also noticed some loose rails, a piece of rail which had been twisted like tinfoil, and several small piles of shattered wood—beam-like pieces cut or broken into such small lengths that they could have been burnt in an ordinary fireplace. But it is that lonely buffer that I shall remember when the Welwyn crash of January, 1957, is recalled.

The buck-eye coupling which helped to prevent a worse disaster consists, as many readers will be aware, of two jaws which lock rigidly on impact. It is by no means a new invention and is in general use throughout the United States.

## Why the delay ?

One might suppose that any fairly simple device which makes rail travel safer would be installed throughout the entire British railway system immediately its advantages were manifest. Yet the buck-eye automatic coupling which can save coaches from telescoping or closing up (piling up beside one another) is not fitted to every train in Britain.

More than half a century ago, after the frightful accident to the American boat train at Salisbury Station one quiet Sunday morning, MODEL ENGINEER drew attention to the advantages of automatic train control as a safety measure. How terrible does a rail disaster have to be, and how many rail disasters must occur, before every train in Britain is fully protected?

## Stories of models

A LETTER from Mr Anthony Beaumont draws attention to the absence in MODEL ENGINEER of articles describing models.

"In former days, the perusal of other people's descriptions of their models and how they overcame all sorts of difficulties with modest equipment must have been a source of great interest to many."

Mr Beaumont went on to say that as there were no appeals for such contributions in the issue he assumed they were no longer thought to be of prime importance.

Let me say right away that that is not so. But my own experience of such matters is that it is easier to persuade a model engineer to undertake the most difficult workshop operation than to get him to write about his models.

However, let me put the matter right by saying without equivocation

# SMOKE RINGS . . .

that we welcome readers' stories about their models. Obviously, we reserve the right to refuse those which we do not consider suitable but we shall be very glad to give an opinion on manuscripts. They should be accompanied by photographs or drawings and, of course, should have the inevitable stamped addressed envelope.

## Opportunity knocks

I WAS talking this week to a well-known model engineer who told me that he obtained a good job many years ago through mention of a vacancy in this column.

It came to mind later when I heard of a job which I felt would be of great interest to model engineers. It is for a skilful workshop man who is interested in experimental work and who has sufficient enterprise to develop ideas on his own. Skill at setting up a lathe is essential but probably the first requirement is a lively and inquiring mind in all forms of model engineering.

This may sound a tall order to those who are not well acquainted with model engineers but, having some knowledge of them I feel confident that it may catch the interest of either a likely young man who would gain valuable experience or perhaps an older man who is more concerned with doing a congenial job than in making his way in the world.

The question of money is always important, so perhaps I should make it plain that the job carries adequate wages but is not worth a fortune.

If these conditions interest any readers, I shall be glad to pass on further particulars.

## More steam ?

IT begins to look almost as if one of the interim provisions of the Railway Modernisation Plan will have to be modified. Sometime after 1970 electric traction is intended to be the source of tractive power on many of the principal trunk routes out of London; meanwhile, it is intended to gradually replace most of the steam power now operating on those routes by diesel power.

The prospects of this, however, are bound to be adversely affected if the present difficulties in the supply of fuel oil persist much longer.

It is all very well to build diesel locomotives, but they are not much use unless fuel for them is readily available. Scarcity of fuel could be a serious matter that might conceivably delay the increase in the use of diesel locomotives; but if fuel oil prices rise again, even if supplies are sufficient, there might well arise a serious situation that could bring about a drastic curtailment of dieselisation.

What then ? The answer is undoubtedly *steam*, and more of it !

## " City of Truro "

AMONG the treasures in the Railway Museum at York is the famous G.W.R. 4-4-0 express engine *City of Truro*, claimed to be the first land transport vehicle to reach 100 m.p.h. This feat was accomplished on 9 May 1904, during the " record of records " run with an Ocean Mails special from Plymouth to Paddington when the entire journey of 247 miles was run in 226 minutes, including a stop at Bristol for changing engines.

Although it has been questioned by certain experts in recent years, the maximum speed achieved by *City of Truro*, when descending the Wellington bank towards Taunton, was stated to be 102.3 m.p.h., a hitherto unimagined rate of progress on rail or road.

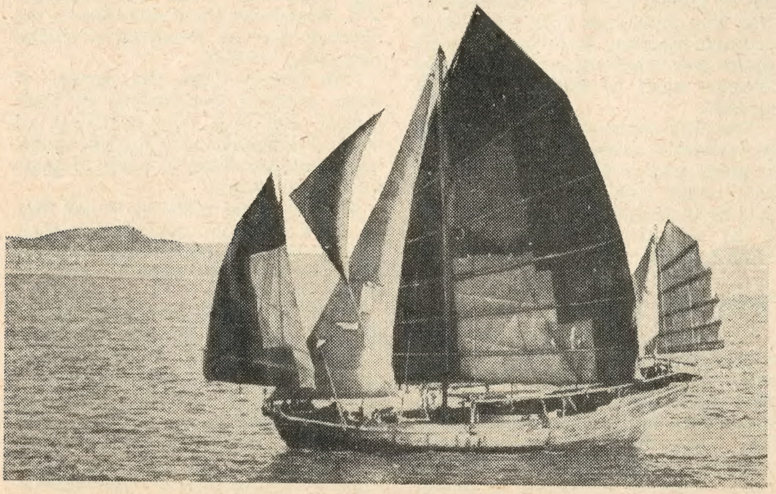
Whatever the precise maximum may have been, the evidence supports the idea that it was at least 100 m.p.h.; but it was kept a close secret for nearly 20 years, owing to the possibility of its publication frightening the travelling public.

Since her retirment in 1931, *City of Truro* has been preserved at York; but she is being brought out this year to run a number of railway enthusiasts' excursions, though probably not at 100 m.p.h.!

## Cover picture

*The Bumble Bee is a modified version of the popular Busy Bee engine. A 50 c.c. two-stroke with $1\frac{5}{8}$ in. bore × $1\frac{1}{2}$ in. stroke, developing a steady $\frac{1}{2}$ h.p. at 3,000 r.p.m., the Bumble Bee is admirably suited for driving small generators, lawn mowers and rotary water pumps. Its construction was described in* MODEL ENGINEER *during* 1954. *Castings are available.*

*This Chinese fishing junk is a queer mixture of modern and not so modern. For sailing in becalmed seas, or making way against adverse wind or tide, it is fitted with a Perkins P4(M) marine diesel engine supplied under the Colonial Office loan scheme to fishermen. It is pictured between Hong Kong and Portuguese Macau*



## Gross exaggeration !

THE recent note on Stroudley's engine green [Smoke Rings, December 6] brought me a friendly letter from Robert Ingham Clark and Co., the " firm of paint manufacturers that no longer exists ! "

It is gratifying to know that the firm is still going strong, and that the statement about its non-existence is, like the famous announcement of the death of Mark Twain, grossly exaggerated. My apologies to the firm and all good wishes for the future.

Incidentally, with the letter came copies of two interesting brochures; one is devoted to Britannia marine finishes and the other to Britannia transport finishes. Both give much information and advice on primers and paints for external and internal protective coverings.

There is, clearly, a very great deal for the uninitiated paint user to know if he wants the best results.

# *The first 1,000 miles*

**Why not enjoy the added thrill of putting your model to useful work? asks ERIC HAWKESWORTH**

THIS ACCOUNT of a summer-time business-cum-hobby miniature railway venture, covering the first three seasons' operation, the thirty-thousandth passenger and the first thousand miles' running, will I hope be helpful to fellow live-steam enthusiasts who are contemplating public passenger work.

Miniature loco. constructors—in any gauge from 2½ in. upwards—who spend years building the little engines and then steam them but twice a year or imprison them in glass cases are, to my mind, missing half the fun of the hobby. I strongly recommend builders to follow through to a natural conclusion the potentialities of miniature working models by letting them *work*.

Using a simple, straight portable track you'll be welcomed in open arms by the fete and gala and field day organisers of your district to say nothing of church garden parties. You'll soon learn all vicars are natural steam fans!

In no other way will you so quickly learn the high spirited wilfulness of your creation . . . and how to tame it! Then it's joy indeed as you open up the regulator and let the engine bark its happy load of children into seventh heaven.

**Equipment**

All my running has been done with a 7¼ in. gauge Royal Scot 4-6-0 type and to its credit—and that of the designer, Mr Henry Greenly—it has never once failed in service.

Seasons 1954 and 1955 were run on a 100 yd circular track, mostly in a nearby public park and in co-operation with the local council. Five four-seater double-bogie passenger cars were used during this period.

The 4-6-0 wheelbase seemed perfectly happy on the 45 ft radius curves with no apparent wear either on wheels or rail—of light alloy flat bottom section.

During the first season several forms of solid fuel were tried, ranging from Coalite to anthracite. With anthracite "peas"—pieces about ½ in.—the Scot steamed well but tended to clinker rather badly.

Anthracite nuts—2 in. lumps just big enough to go through the firehole door—completely cured this clinkering and now the fire need hardly be raked after eight hours continuous steaming. Why? Don't ask me; possibly the large lumps never burn down into a tightly packed cinder bed.

Several modifications were put in hand during '54 winter including a form of gravity-steam sanding gear using sifted silver sand. Another conversion was the substitution of the original steel firebars by ones of cast iron. These cast ones are in two halves and may be fished through the firehole door for occasional cleaning. A local foundry casts me sets of bars from a simple home-made pattern when required.

Perhaps no other one problem puts the steam fan off public running than insurance. What with passenger liability plus the trouble of boiler coverage one begins to wonder if it is all worth while—my own feelings during the first season of steaming.

However, I discovered a nation-wide company of high repute willing to cover me—subject to their approval of the site and fencing—both for passenger liability and boiler risk.

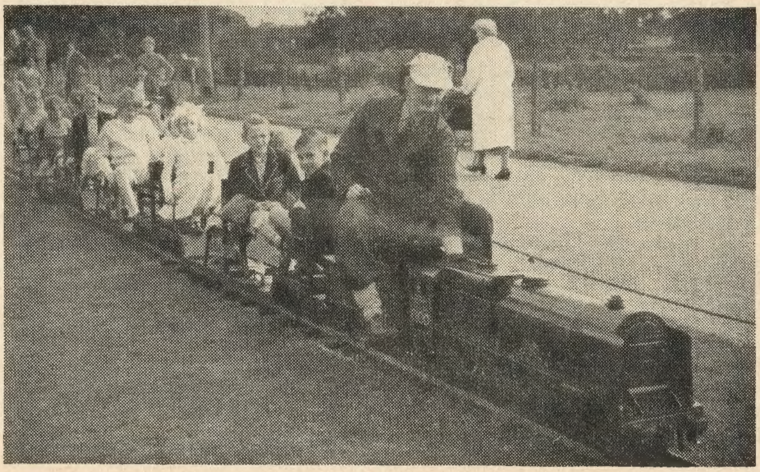
The boiler risk was a special model maker's concession using double hydraulic and one and half times steam pressure as test figures. This form can be completed by some person nominated by a model engineering society as being competent to do such a test. Thus, for a very reasonable fee you can dispose of the insurance problem.

In 1956 I tried a new approach by making the miniature railway layout completely mobile. I reasoned that by taking the train to the people trade would be brisker during the hours actually in steam.

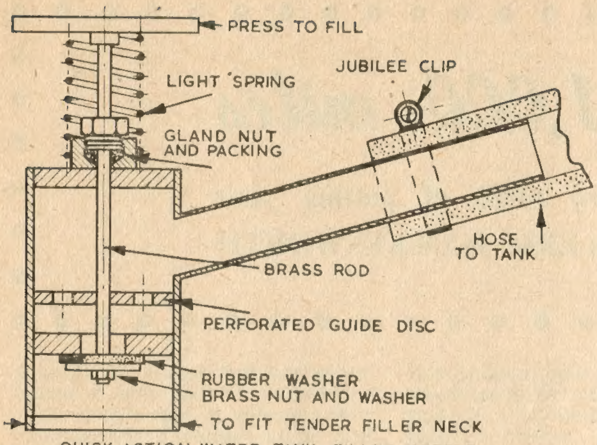
A letter or two to various organisers in January brought a terrific response. So great was the demand for miniature live steam that by February every Saturday was booked between Whitsun and August.

My two-wheeled trailer was modified to take the following set: the engine and tender coupled together; three

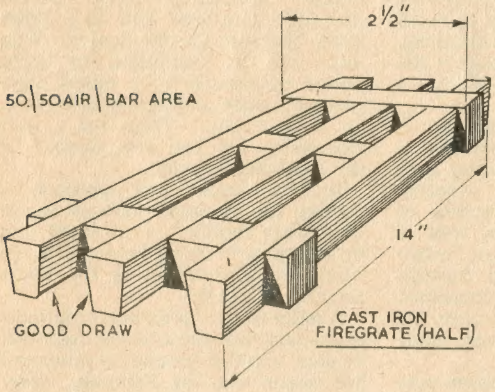
*En route for seventh heaven. The author driving a train load of youthful enthusiasts in a local park (Derby Evening Telegraph picture)*



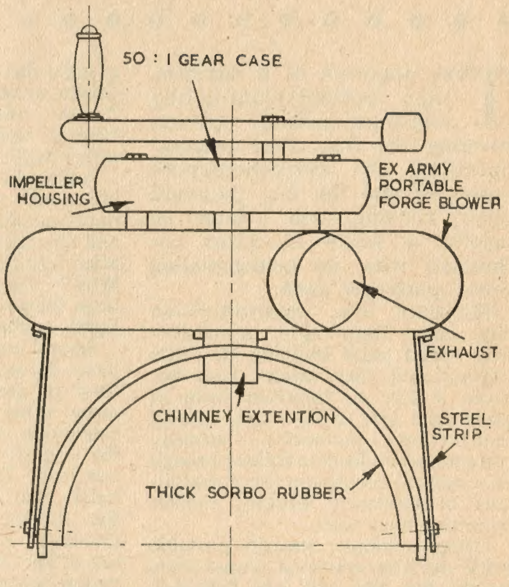
*Details of the special equipment that the author has evolved to meet the demands of portability*



QUICK ACTION WATER TANK FILLER NOZZLE



CAST IRON FIREGRATE (HALF)



CURVED BOILER HOLDING BRACKET

passenger cars with bogies; 60 yards of straight alloy track in 12 ft sections; water tank, fencing posts and rope. Tools, steam-raising blower and coal, etc., go in the back of the car.

Providing the site is reasonably flat the track can be put down and the engine steamed and ready to run in little over the hour. Packing up takes about as long. This is really the life !

No worry over hooligans ripping up the track at night or breaking open the engine shed as happened in the park. You bring it all home with you ! Despite the wet summer it was a thoroughly enjoyable one with good running and meeting dozens of enthusiasts.

At one gala near Toton, I was under steady fire all afternoon from Toton locomotive men—chaps who drive anything from Garratts to Class 8s. My firing and driving technique improved considerably that afternoon !

Insurance cover was gladly extended for the days out, and the fencing requirements adequately met by posts and rope round the track.

A complete account of all income and expenditure should be maintained for income-tax purposes so as to keep the thing on a business-like footing.

It is easy to issue tickets and file bills, etc., which apart from being necessary in compiling the accounts provides you with a useful and interesting record.

Items picked from my first thousand miles include: total coal consumed, 22 cwt; cylinder oil, mostly Castrol Hypress, 3 gal.; and, to the nearest 10 gal., 4,000 gal. of water have been boiled !

It speaks volumes for the all-copper boiler that no scaling to speak of has been encountered. But the boiler is removed from the frame each winter for a thorough washout and test. As British Railways have discovered to their cost, a little regular routine maintenance conscientiously carried out is worth expensive rebuilds.

There it is then, chaps; why not have a go ?

" All right for some people with plenty of means," I can hear some of you mutter. Bosh ! If you've got an engine you're three-parts way there. Get that track constructed this winter—length is a secondary consideration, so long as it is portable.

With up to 5 in. gauge stuff you don't even need a trailer. The fete organisers will gladly collect and deliver the track leaving you only the engine for the back of the car.

You'll enjoy it. You'll spread the live-steam gospel and give a lot of pleasure to a lot of people. ▣

---

## HISTORIC LOCO MODELS

*Locomotives Worth Modelling*, by F. C. Hambleton, gives descriptions of many famous engines of the pre-grouping period including: the old Midland No 1447; London and South Western No 591; London Chatham and Dover No 145; the famous Great Northern Number One; and the Manchester, Sheffield and Lincolnshire No 694.

Lavishly illustrated throughout its 176 pages with detailed drawings it is obtainable from Percival Marshall and Co. Ltd, 19-20, Noel Street, London, W.1, price 10s. 6d., postage 8d. (U.S.A. and Canada $2.50).

# Accurate length machining

By GEOMETER

As in the case of diameters, there is not always the need for precision on width and length measurements—but when it is demanded accuracy is no less important on the one than the other. Given a micrometer, diameters can easily be checked as work proceeds; but if width and length measurements have habitually been made with a rule—with all the variations that that implies—the need for greater precision may find one unprepared. Yet accuracy when machining widths and lengths is relatively easy to achieve.

On a lathe having a topslide feed with graduated collar readings can be taken from this for positioning tools for facing cuts, and in some instances longer lengths can be obtained using the leading screw. Again, very accurate work can be done using simple gauges for setting tools, and this is often practised as occasion demands even on lathes fitted with feed collars.

For old-type lathes without feed collars, or on which screws are worn, the use of gauges is virtually imperative to ensure precision and speed up production.

The principle is as illustrated at *A*, where a piece of material is turned with two shoulders. The lengths could be measured with a rule; but a much more precise and speedier way is to machine the lengths slightly oversize then employ two gauges *X*1, *X*2, to set the tool for finishing cuts. With the lathe stopped, a gauge is held to its respective shoulder and the tool set just to touch; then the gauge is removed and the cut taken at the precise position.

In most workshops there are numerous objects of reasonable precision, such as drill shanks, silver-steel rod, pieces of ground tool steel, etc., in standard sizes which can be used as gauges. If a micrometer is available material may also be turned or filed to size, and then it is possible to add to or delete from nominal dimensions for particular fits.

For example, if a flange is nominally $\frac{1}{8}$ in. wide, but for a clearance fit 0.002 in. endplay is desirable, then the gauge could be made $\frac{1}{8}$ in. minus 0.002 in. Again, if necessary, widths and lengths can be obtained falling between inch fractions, which would demand estimation on a rule.

The chuck face or a jaw can be used as a datum for gauges, but one extra is required since the two gauges, *Y*1, *Y*2, only locate the end face and one shoulder; another would be needed for the second shoulder. Besides this, the gauges are in general longer and would require to be made specially.

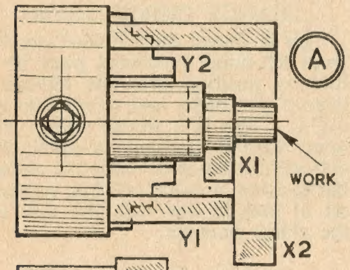
On second operations, however, measurements can be made from the chuck face or jaws, though when a holder is used it is best to work from its face which, as at *B*, should be flat and large enough to take the gauges squarely.

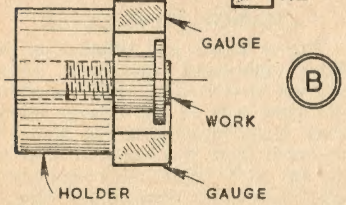
As at *C*, a recess can be machined to depth by finishing the interior over-length, then using a gauge to set the tool for the outside facing cut. Where a groove must be accurately located from the end face, either of two methods can be employed. The tool edge may be set flush with the end face, then taken in by feed collar reading, or a step gauge can be used, *C*.

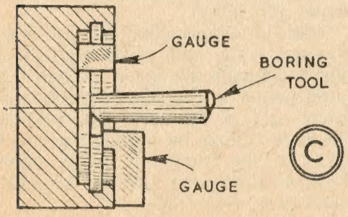
The principle is applicable to back-facing flanges, as at *D*, where the gauge is a simple adjustable type set by using a block of suitable thickness in conjunction with a straight-edge.

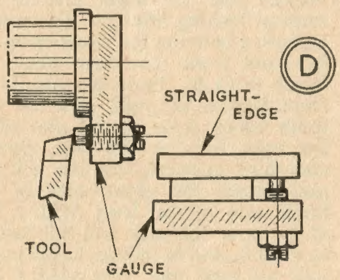
A variation of such a step gauge—snipped or sawn, then filed from sheet metal—is as at *E* for obtaining the over-all dimension of a pair of flanges on a shaft machined between centres. Beyond the flanges, the shorter lengths can be obtained with other gauges.

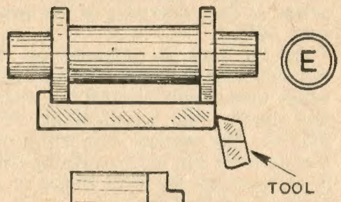
Locating from the saddle, as at *F*, an adjustable stop can be fitted to the headstock to take gauges in the space, *Z*. ■

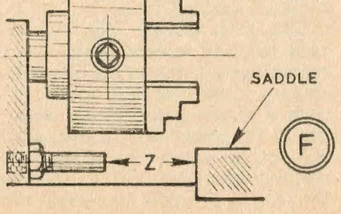


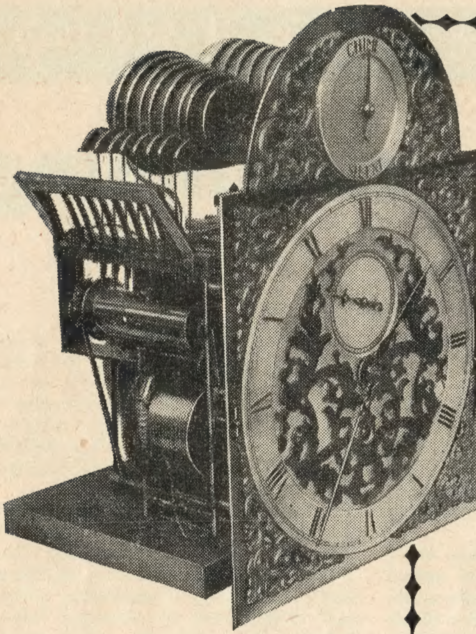





The M.E.

# MUSICAL CLOCK-10

By C. B. Reeve

**The chiming sequence is dealt with in this week's instalment on this excellent timepiece**

*Continued from 17 January 1957, pages 102—105*

LOOKING AGAIN at the cam locking lever, it will be noted that at the extreme left-hand end there is a hook whose point is resting in a notch on the circumference of a disc known as the locking plate.

So long as the point of the hook is in the notch of the locking plate the musical train will be locked, but when the point of the hook is out of the notch and resting on the circumference of the locking plate the musical train will run subject to the warning wheel not being locked, which will be explained later.

The locking plate does not of itself arrest the train, but controls the position of the cam locking lever. The locking plate is clamped on to the extended pivot of the second wheel of the musical train.

Referring again to Fig. 34, there will be seen a long two-arm lever nearest to the top of the front movement plate. This is the musical warning lever, referred to as M.W.L. Every time the rack falls, the right-hand end of the long arm of the lever will also fall and with it a stop block which is attached to it and passes through a slot cut in the right-hand front movement plate.

When in the down position the stop block is ready to arrest the rotation of the musical warning wheel by intercepting a pin placed in the rim of the warning wheel. But as the musical train is only released at the hour, it is returned again to its usual resting position by the same pin on the under side of the rack that locks the wing of the gathering pallet.

Looking at Fig. 34 again, it will be noticed that the lower arm of the musical locking lever No 1 is resting against a banking pin situated on the left-hand front movement plate, referred to as *B*. There is a pin in the front face of the rack near the first tooth which is so placed that when the rack falls at the first, second and third quarters, this pin will not quite reach the upper edge of the lower arm of the lever *MLL* 1, but at the hour the rack will fall farther to the left, and in falling the pin in the rack will push past lever *MLL* 1 and arrive at the under side of the arm of lever *MLL* 1.

As the rack is gathered up, this pin will raise the lower arm of *MLL* 1 which in turn will raise *MLL* 2, *MLL* 3 and finally the cam-locking lever, *MLL* 4. The musical train will at once run until the pin in the warning wheel is arrested by the stop block of the musical warning lever.

This lever having fallen when the rack fell, the musical train will thus remain locked during the chiming and striking until the last tooth of the rack is finally gathered up, when the pin in the under side of the rack will contact the lower arm of the musical warning lever and raise it, and with it the long upper arm, to normal resting position. As soon as this happens, the musical train will run and play its tune.

This is a long explanation, but it is given in full in order to make the various actions clear.

### CHANGE CHIME LEVER

This is shown and situated on the front left-hand movement plate in a midway position near the left-hand edge of the plate, and referred to as C.C.L. This is a simple affair. Its upper arm is partially bevelled off, and its function is to pump the chime barrel arbor endways to bring another set of pins in line with the tails of the chime hammer.

### CHANGE TUNE LEVER

This is shown and situated on the front right-hand movement plate, referred to as M.C.L., and it functions the same way as the change chime lever. Referring again to Fig. 34, it will be noted there is a two-arm lever at the top of the centre movement plate, and it is used for silencing the chimes, strike and music.

There is a chime silent dial and hand situated in the arch of the dial plate, which controls this lever. When this hand points to the silent position the lower arm of the lever will prevent the rack falling by contacting a pin fitted in the front fall of the rack. This pin is situated towards the right-hand end of the rack.

### CONSTRUCTION OF THE VARIOUS LEVERS

Fig. 35, No 1. The gathering pallet. Make the hub from a short length of 3/32 in. mild-steel rod which is riveted from the under side to the flat winged part of the pallet.

Drill centrally a small hole in the rod. Next a broken piece of a square needle file is gently hammered into the hole and driven out again. This process is continued until a nice internal square has been formed. It must fit the square on the front pivot of the pallet wheel arbor in all four positions.

When finally riveted to the winged part of the pallet, the under side of the latter should be at a distance of about 5/32 in. from the front movement plate. The drawing gives the dimensions required. The finishing of the extremities of the wings to length are better left until the rack has been made.

To lock the gathering pallet to the square of the pallet, first a very small hole is drilled in the latter and a cross pin fitted. As an alternative the end of the square can be threaded and a minute square nut made and fitted.

The writer prefers this way, although not often seen. Two pins of 1/32 in. dia. are fitted to the winged part of the pallet diametrically opposite each other, their centres apart being approximately $\frac{3}{16}$ in. These pins do the gathering up of the rack.

### THE RACK

Fig. 36, No 1. The rack is cut from a piece of 1/32 in. or 3/64 in. thick mild-steel plate. A centre pop is made for the position of the rack hub centre, and an arc scribed from this centre with a radius of 2 15/32 in., which will represent the distance from the tips of the teeth to the rack centre.

If possible, the points of the rack teeth should be cut with a fine slotting saw in the lathe. This can be arranged by mounting a $4\frac{1}{2}$ in. dia. wood disc on the face or catchplate of the lathe, and clamping the blank rack in position on the wood disc. Bring up the tailstock centre to the popped hole in the rack and clamp the rack to the disc with a number of drawing pins inserted at convenient positions.

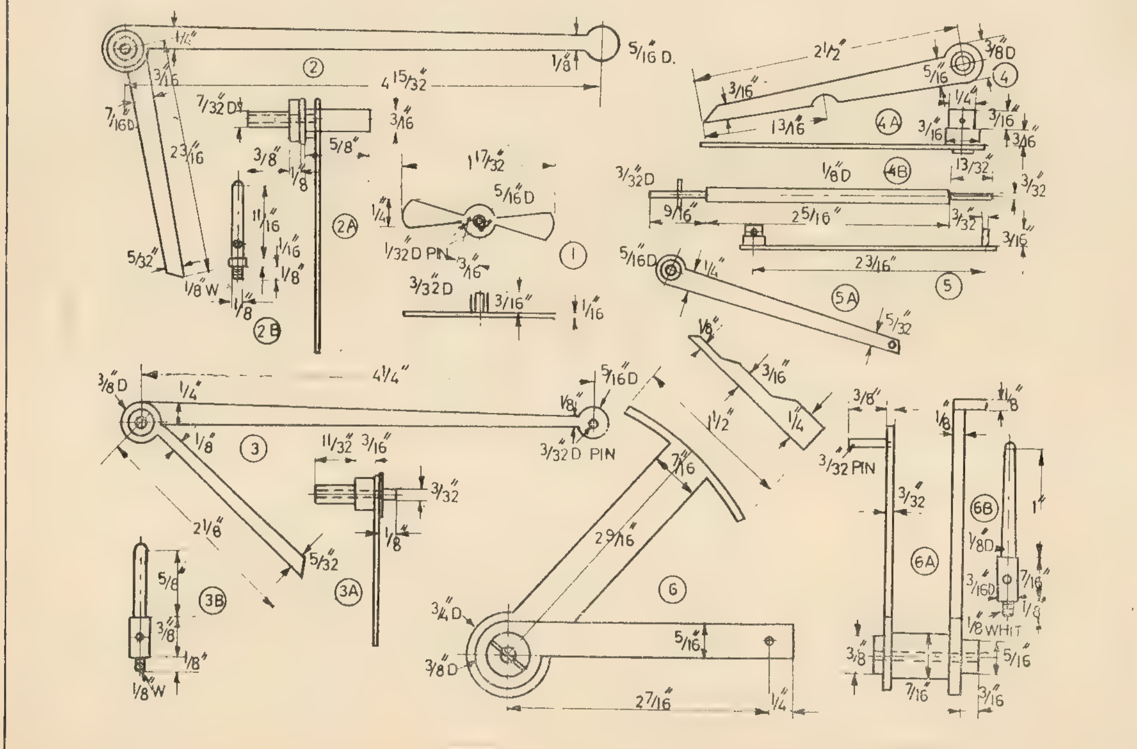
The segment at the top of the rack can now be turned by a sharp knife tool, by partially rotating the lathe mandrel by hand. It is difficult to state the pitch distance between each tooth, but the distance from the first tooth to the last or nineteenth should not exceed $1\frac{1}{2}$ in.; slightly less would be better; if a division plate with a 192-hole circle or thereabouts is available, this will give the pitch distance of the teeth. The teeth should be slit through, and the depth of the cut is a full 3/32 in.

Now demount the rack from the faceplate and cut the backs of the teeth by hand with a fine fretsaw, taking care not to encroach into the cut made by the slitting saw. Follow this by filing the backs of the teeth with a small half-round needle file to form a nice curve to the backs of the teeth. This is necessary to allow enough room for the pins of the gathering pallet to function without catching on the backs of the teeth.

The rest of the rack should now be cut to shape and nicely finished off. A $\frac{1}{16}$ in. dia. hole is drilled where the centre pop was made. All the tips of the rack teeth should be very slightly reduced except the first, so that when the rack hook is raised from the first tooth it will not scrape all the tips of the other teeth when the rack falls.

To find the rack stud centre on the front movement plate a small length of round steel rod should now be driven in the previously drilled hole

*Fig. 35: Details of the levers of the front movement plate*



# CLOCK . . .

of the rack centre, whose business end is formed into a miniature centre punch.

Referring to Fig. 23, there is a dot marked *S*, situated $2\frac{3}{16}$ in. from the bottom of the left-hand movement plate and $2\frac{5}{8}$ in. from the left-hand side of this plate. Position the point of the steel rod in the rack in the vicinity of this spot, and make the gathering pallet gather the rack teeth.

**Avoiding wear**

The thing to aim at is that the gathering pallet must gather rather more than one tooth at a time, say about one and a half teeth; in other words the rack will recoil a little after each tooth is gathered. This is most important, as if only one tooth is gathered after a short while any wear that might occur would have the effect of allowing the gathering pallet to gather only the same tooth and make no progress in gathering up the remainder of the teeth.

All this can be observed if the rack is held by the temporary steel centre with its point resting on the movement plate. When satisfied that the correct centre has been found, a slight tap on the steel rod will give the position for the rack stud.

Make the rack stud from mild-steel rod. The question arises as to whether the part on which the rack hub rotates should be turned parallel or tapered as shown in the drawing. Actually, either way is quite satisfactory. If the parallel method is adopted, it is better to drill the hole in the hub first and turn down the spigot of the stud afterwards.

Remove the miniature centre punch from the rack centre and enlarge the hole to fit the spigot of the stud. The depthing of the gathering pallet and rack teeth can again be tested. Make the rack hub from a piece of brass rod. The rack centre hole will again have to be enlarged to take the spigot of the hub which is now riveted into a countersink on the under side of the rack. Two further brass hubs are next made to be a sliding fit over the first hub.

**Allow latitude**

The bottom hub carries the short rack tail and the upper one the long rack tail. The total distance between the pivot centre of the rack and the pivot centre of the centre wheel of its time train will be the position of the pin in the end of the long rack tail and the pivot centre of the lower minute wheel will be the position of the pin in the end of the shorter rack tail. A little latitude either way will make no difference.

Fig. 36, No 1. The long rack tail projects either side of the rack centre. The left-hand end carries a small brass weight which is screwed into the circular shaped end of the arm. Its purpose is to cause the rack to fall when the rack hook is raised. The hubs of the two rack tails are not riveted to the central hub, but are clamped to the latter with No 12 B.A. setscrews.

This allows of independent adjustment of the rack tails with their respective snails, which is very convenient. No 1a is a side view of the rack. The locking pin for the wings of the gathering pallet is $\frac{1}{8}$ in. dia.

The short pin of $\frac{1}{16}$ in. dia. on the front face of the rack is for raising the musical locking lever, and the longer pin of the same diameter also on the front face of the rack engages with the chime silent lever mechanism situated on the dial plate.

## RACK HOOK

Fig. 36, Nos 2 and 2a is this fitment and its stud. It is cut out from $\frac{1}{16}$ in. thick mild-steel plate, and the hook portion is thickened by another piece of the plate riveted to it from the back of the main arm. The right-hand side on the front of the hook is an arc struck from its pivot centre. The left-hand side can be struck from the same centre, although it plays no part in the functioning of the rack hook.

The point of the hook should not completely fill the space between adjacent teeth, which might at first sight be thought desirable. The hook should just lie in the top of the widest space of two teeth tips.

If the hook is shaped as shown in the drawing, this will obtain the approximate pivot centre of the hook, as shown in Fig. 23 at 1 3/32 in. from the left-hand side of the movement plate, and $2\frac{3}{8}$ in. from the top of the movement plate. The exact position must be obtained by trial in a similar manner as that of the rack pivot centre, bearing in mind that the gathering pallet must gather a good one and a half rack teeth as previously stated.

The locking pin for arresting the wings of the gathering pallet should now be placed. This pin is screwed into the thickness of the rack and it is so placed that when the rack is fully gathered up the tip of the gathering pallet wing will rest on half the diameter of the pin. It is also necessary that when the rack hook is in the space between the first and second teeth of the rack, the tip of the gathering pallet wing must be clear of the pin in the rack.

## MARKING OUT THE HOUR AND QUARTER SNAILS

These two items are better marked out in the clock movement itself. Assuming the rack and the rack hook are ready pivoted on their respective studs and that the blanks for the snails have been fitted to their respective wheels, proceed as follows. Where the pins are to be inserted later in the long and short rack tails, insert, firmly, short lengths of small diameter steel rods with sharp pointed ends.

Taking the hour snail first, before fixing the circular blank to the hour wheel hub divide it into 12 equal segments. The full diameter should be about the same as the hour wheel. Put the rack hook into the fifth tooth space of the rack, then adjust the long rack tail so that the sharp point in its end is just inside the circumference of the blank snail.

Next tighten the clamping screw of the hub and scribe an arc on the first segment of the snail. Move the rack hook into the sixth tooth space of the rack and scribe an arc on the second segment of the snail. This should be continued until all the steps of the snail have been scribed.

It is as well before scribing any of the steps, to try the position of that of one o'clock and 12 o'clock (i.e., the 12 o'clock step must not come too close to the hour wheel hub). The steps of the quarter snail should be scribed out in a similar way.

In this case the rack hook is put into the first tooth space for the first quarter, the second tooth space for the half hour and the third tooth space for quarter to the hour. The fourth segment of the quarter snail as previously stated is cut away so that the pin in the short rack tail does not reach the snail.

The snails should now be removed from the wheels and have the steps cut, taking particular care not to encroach inside the scribed lines. If this be carefully done, and the rack tails are correctly adjusted, the racks should perform their duties perfectly. It should be remembered that when the rack is finally gathered up with the gathering pallet resting on the rack pin, the pin in both rack tails must be clear of the highest steps in the snails.

The proper or final pins for the rack tails should now be made. They are 3/32 in. dia. and are screwed into the thickness of the tails. The tails themselves are made from 1/32 in. brass. The shorter tail falls in the space between the lower minute wheel and the quarter snail, the pin being on the front face of the tail.

The long rack tail falls in front of the hour snail, the pin being in the back face of the tail. It is usual to

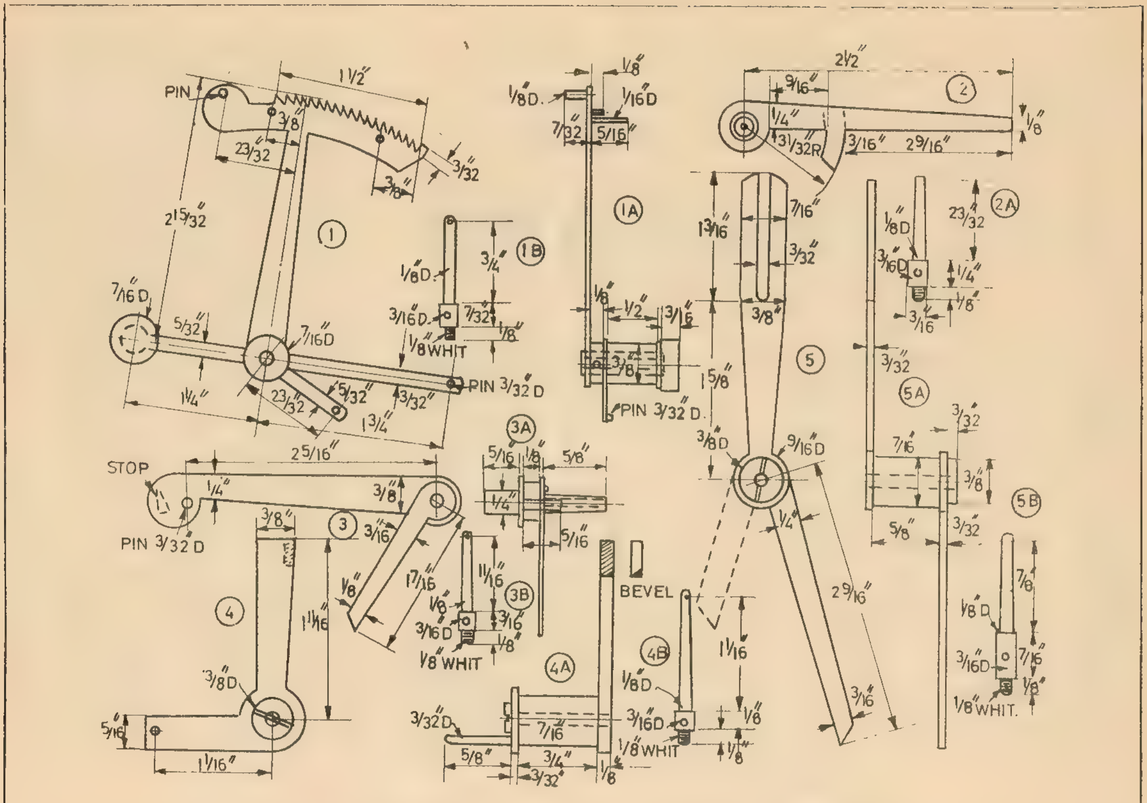



*Fig. 36: Further details of the levers of the front movement plate*

bevel off the side of the step between one and 12 o'clock of the hour snail, in case failure of the chiming and striking should occur, which would cause the pins in the rack tail to be locked by the long step in the snail if it is not bevelled off.

### THE LIFTER

Fig. 36, Nos 3, 3a and 3b. It is cut from $\frac{1}{16}$ in. mild steel and the lower area from 1/32 in. sheet brass. The pivot centre is shown on Fig. 31, 1 in. from the top of the right-hand front movement plate and 5/32 in. from left-hand side of the plate. There is a stop block riveted to the left-hand end of the upper arm, which goes through a slot cut in the right hand of the left front movement plate.

The angle that the stop block has with the pin in the warning where it contacts it is important and needs careful consideration so that the lifter drops smartly away from the pin when the lower arm is released by the quarter pins in the minute wheel.

Projecting from the front face of the lifter and to the right of the stop block is a 3/32 in. dia. pin for raising the rack hook. When the lifter is in its normal resting position, this pin should just be clear of the underside of the rack hook. Its hub and stud are made on similar lines to that of the rack and rack hook.

### CHANGE CHIME LEVER

Fig. 36, Nos 4, 4a and 4b give the details of this lever, which is made of brass. The steel pin comes through a long circular slot cut in the dial plate. The upper arm is bevelled so that it can pump the rounded end of the chime pivot arbor for changing the tune of the chimes.

The hub of this lever should work quite stiffly on the stud and there is a washer distance piece with a diametrical groove for taking the cross pin which goes through a hole in the stud. The position for the stud is shown in Fig. 23, 7/32 in. from the side of the left-hand front movement plate and $3\frac{9}{16}$ in. from the bottom of the plate.

### CHIME SILENT LEVER

Fig. 36, Nos 5, 5a and 5b, shows the details of this lever. In No 5 the lower arm is pointing to the right. This, however, when viewing the lever from the front, should point to the left as indicated by the hatched lines.

It is made from brass and cross-pinned to its stud. A pin fixed to the mechanism attached to the back of the dial plate enters the slot in the upper arm of the lever. The stud centre is shown in Fig. 23, $\frac{9}{16}$ in. from the left-hand side of the centre front movement plate and $\frac{1}{8}$ in. from the top of the plate.

● *To be continued.*

### GEAR CUTTING

*Gear Wheels and Gear Cutting*, by Alfred W. Marshall, explains the principles which govern the formation and numbers of the teeth for a given mechanism and describes the types of gears in general use.

There are numerous illustrations in this 92 page book, price 3s. 9d. post paid, which can be obtained from Percival Marshall and Co. Ltd, 19-20, Noel Street, London, W.1. Rate in U.S.A. and Canada is $1.00.

B. G. PHILLIPS deals with the armament, rails and masts in this, the second, instalment

# U.S.S. CONSTITUTION

*Continued from 24 January 1957, pages 117—121*

As in the case of spars and rigging, armament was left to the wishes of individual captains, and I believe in many cases ships were over gunned.

Originally *Constitution* was to have thirty long 24 pounders on the gun deck; twenty or twenty-two long 12 pounders on the quarter deck and fo'c'sle with two more long 24 pounders on the fo'c'sle as chase guns. The 12 pounders intended for the upper deck, however, were to be replaced by 42 pounder carronades before the ship was commissioned. Carronades had been invented by the British in 1779 and were proving a very efficient gun. Finally, in the early part of her career *Constitution* had 32 pounder carronades instead of the 42 pounders originally suggested.

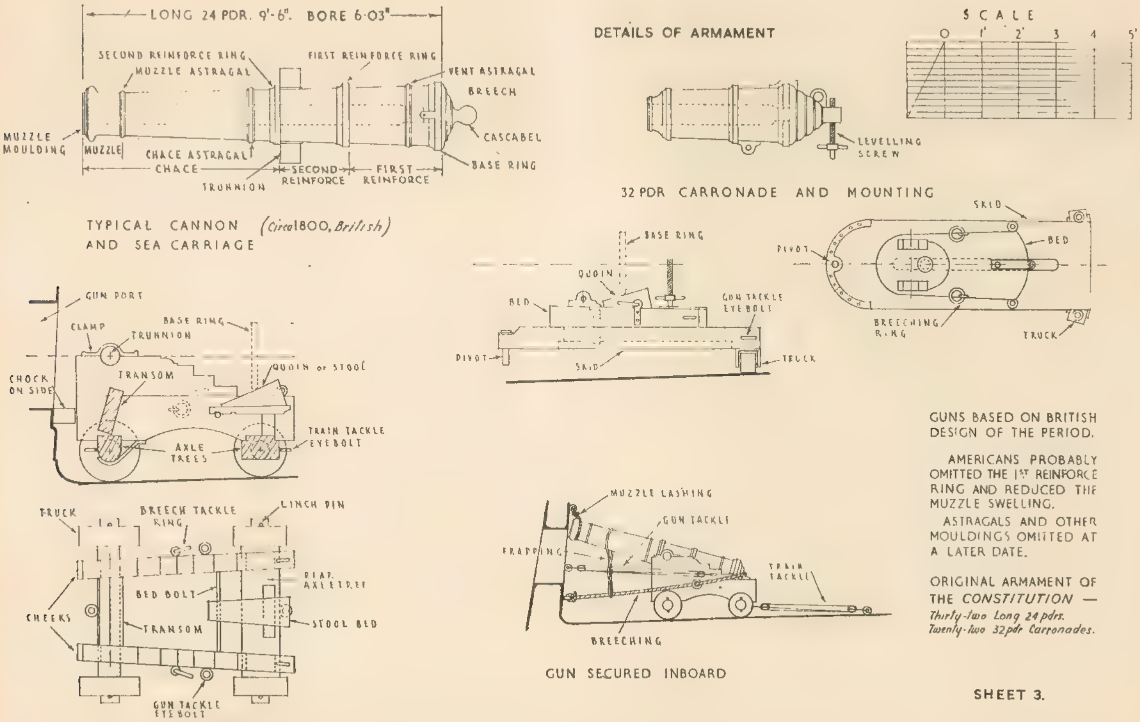
Details of the probable dimensions and appearance of the guns and mountings are shown on Sheet 3 for those who wish to add them to the model, and the drawings are based on English practice of the period. It is not certain what mountings the carronades had on *Constitution*, but Sheet 3 shows the sliding bed which was most probably used in the American Navy. So far as I can see this mounting would necessitate the lowering of the original port sills. American guns were copies of the English, but the control in manufacture was not so exact, and a number of variations arose in the casting. Some guns were longer, some had less taper.

Before passing on to the masts, the fife rails must be constructed and fixed; on my model these were built up with wooden posts and wood veneer rails with the pins inserted. If much of the rigging is to be belayed to the fife rails in the model it is essential that they be securely fixed to the deck to resist the pull of the rigging.

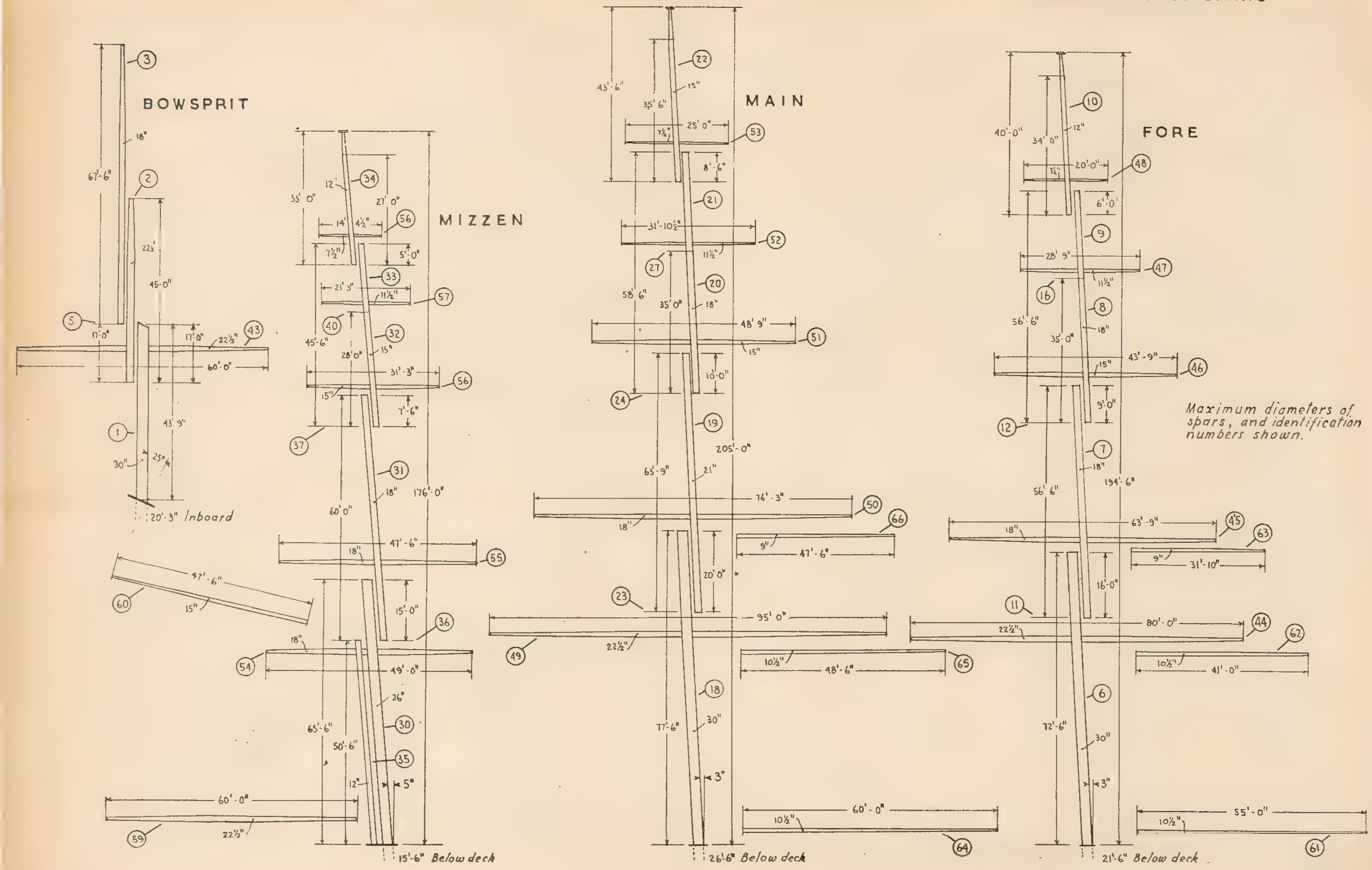
Pin rails must also be fixed to the inside of the bulwarks between gun ports at this stage. They are shown on Sheet 2. Mention has already been made of the channels and rigging eyes in the deck and bows, but before leaving the hull the fore tack and main brace boomkins should be fitted. The boat davits are left until the rigging is complete.

Full dimensions of the masts and spars employed by *Constitution* at the height of her career are given on Sheet 4, and larger scale details on Sheets 5 and 6. How much of the detail is to be included in the model is a matter of choice and skill, but it is important to note the various points of attachment of the rigging. On Sheet 6 the studdingsail booms are shown on one side only, but all yards were symmetrical except the spanker boom and gaff—and any details which may only have been shown on one side of the centre line are to be repeated on the other side.

● *To be continued.*



# DIMENSIONS OF SPARS

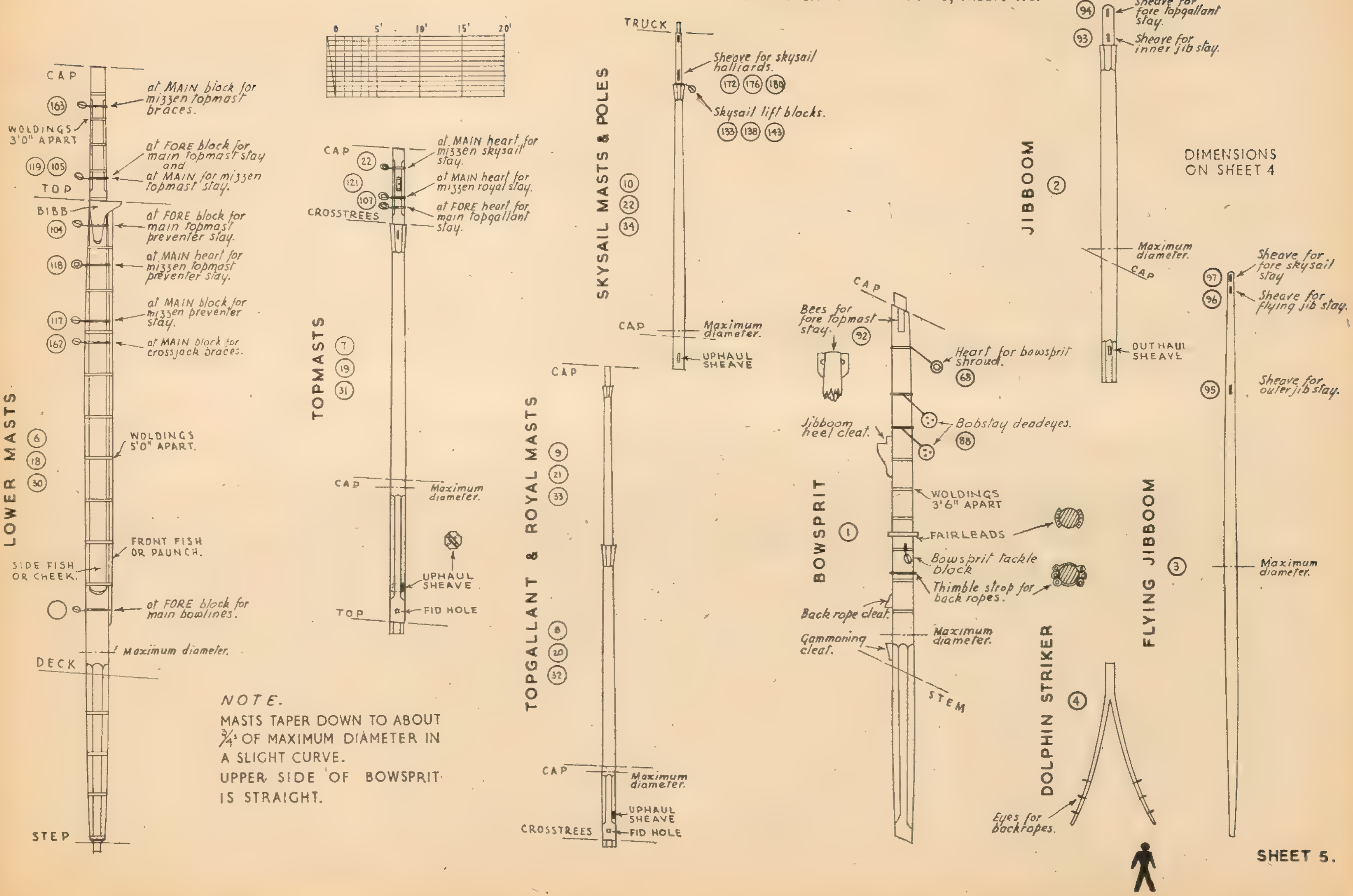



see also TABLES N°2&3

SHEET 4.

# DETAILS OF MASTS

IDENTIFICATION OF RIGGING, SHEETS 7.8.




*NOTE.*

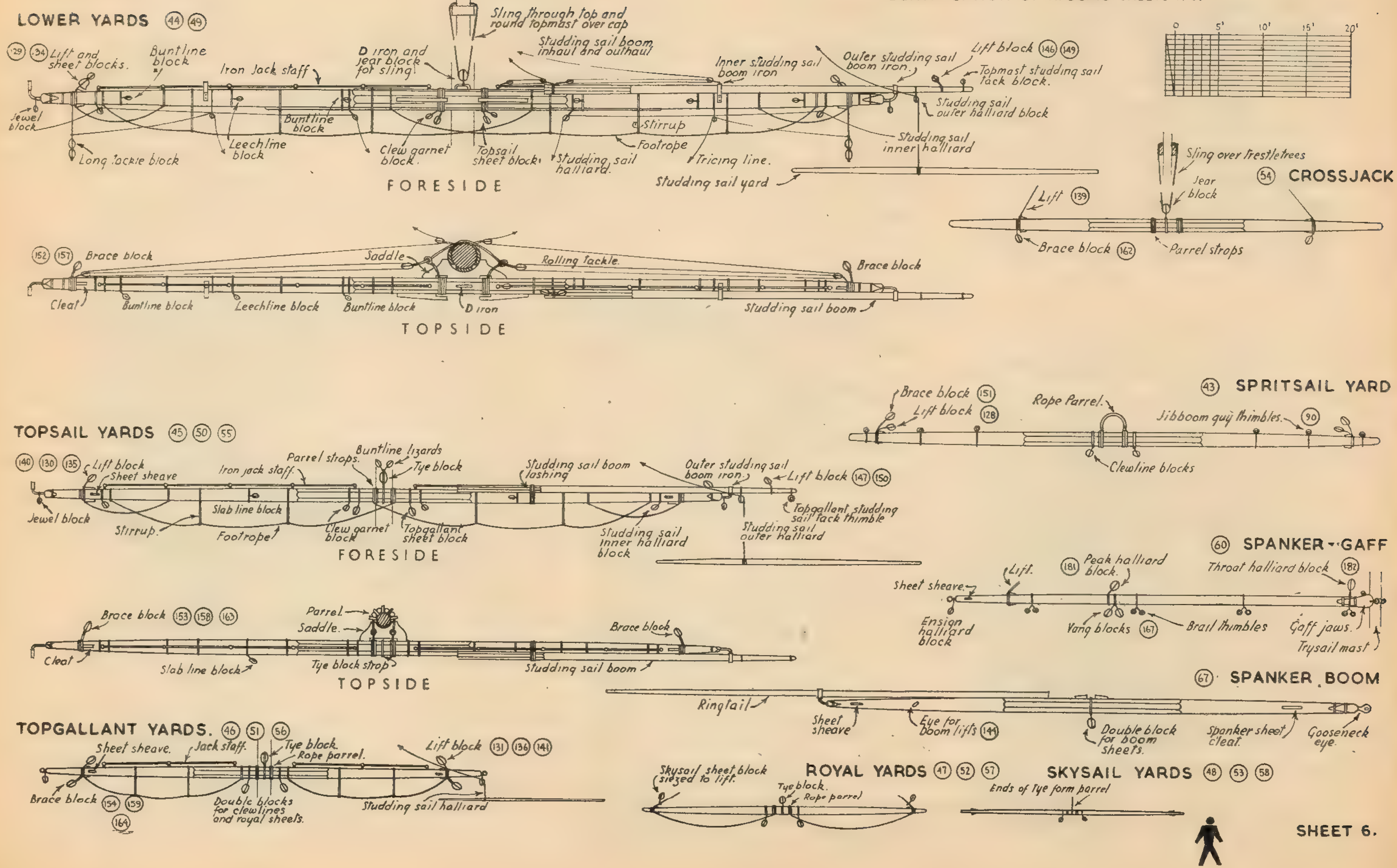
MASTS TAPER DOWN TO ABOUT ¾ OF MAXIMUM DIAMETER IN A SLIGHT CURVE.

UPPER SIDE OF BOWSPRIT IS STRAIGHT.

SHEET 5.

# DETAILS OF YARDS

DIMENSIONS ON SHEET 4.
IDENTIFICATION OF RIGGING SHEETS 7. 8.



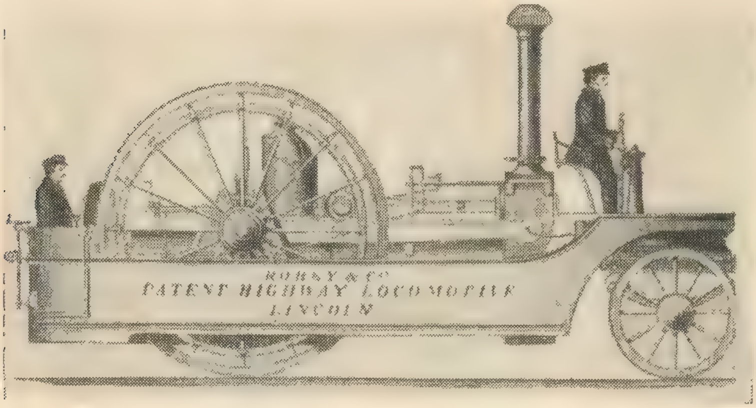

SHEET 6.

# TRACTION ENGINE TOPICS

## *'Centenarian quintette'*

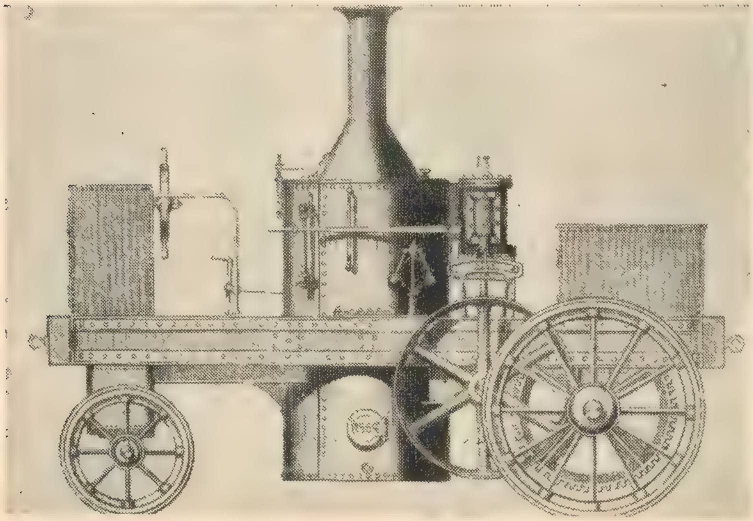
### By C. E. PAGE

*Above*: *Aveling engine of* 1862. *It had a* 10 *in. cylinder, and gear and chain drive*




*Above*: *The Robey Patent Highway Locomotive of* 1862

*Below*: *Engine built by Alexander Chapman of Glasgow*, 1859



NO TRACTION ENGINES were shown at the Great Exhibition of 1851, which was held in Hyde Park, and indeed few were exhibited at other minor shows about the country; thus it was some years before farmers realised that they could be of considerable service for general farm haulage.

But from 1858 a rapid development took place, largely due to the pioneering experimental work of Thomas Aveling who, in 1858, fitted several traction engines with chain transmission in which two chains carried the drive from the engine crankshaft; one chain to each rear wheel.

Then in 1859 Aveling patented an adjustable chain sprocket-wheel, which was first used on the engines he started to build at Rochester, Kent, in 1860; and it was one of these engines which was awarded the first prize gold medal at the agricultural show at Mecklenburg-Schwerin, in Germany in 1862, by which date 40 such engines were in constant use in England.

Aveling's first traction engines were steered by a horse between shafts, but the horse was soon replaced by a pilot castor-wheel mounted at the end of a triangular frame bolted to the front of the centrally-pivoted front axle.

This pilot wheel was steered by a man who worked a tiller connected to the wheel, which was, notwithstanding, very difficult to manoeuvre; so much so, in fact, that other makers used a more normal steering-wheel or tiller mounted on a front platform to turn a centrally-pivoted front axle through gears, or through a chain.

The 1860-type Aveling had what was termed in its day an extra large boiler which housed 37 $2\frac{1}{4}$ in. tubes of best Butterley iron. The 2 ft 7 in.

by 2 ft 10 in. grate was adapted for burning either wood or coal, and the engine, with its 10 in. dia. cylinder, was mounted above the boiler, the steam feed to it being so arranged that there was no priming when climbing a steep hill.

The crankshaft was of selected Lowmoor iron, for the invention of the Bessemer process for the manufacture of steel in 1856 was not yet very well known and steel was, moreover, very expensive.

The Aveling engine would haul itself and a 10 ton load up a gradient of 1 in 6. It cost £420.

Although chains continued to be used for transmitting the drive to the rear axle or wheels, there was an increasing use made of direct gear transmission; for chains undoubtedly proved very expensive because they had to be made very large to carry the high loadings imposed upon them.

The Robey Patent Highway Locomotive of 1860 is an example of an early traction engine having 4½ to 1 gears made of cast iron with chilled teeth, and the 12 h.p. and 16 h.p. two-cylinder compounds by B. D. Taplin, of Lincoln—also of 1860 vintage—were 4 to 1 gear-driven types which were wheel-steered from the rear.

**Use of cast steel**

The chilled iron teeth of these and other similar engines were often broken under load, but it was not until about 1873 that cast steel was substituted for iron, with simultaneous reduction in the pitch and width of teeth by Aveling to give greater strength and reliability.

Cast-steel gear teeth were not in general use on traction engines until about 1878, for although gears were getting more reliable, some makes favoured the chain drive because it was more flexible and lent itself to the mounting of the whole upper structure of the engine on springs; the fitting of which was soon found to diminish wear and prevent excessive damage by chassis twist and vibration.

There were two other traction engines of the Sixties which are worthy of notice, both of which had vertical boilers, though one had a vertical and the other a horizontal engine. Both were built by Alexander Chapman, of Glasgow, the former in 1859 and the latter in 1861. The older engine was guaranteed to do 10 m.p.h. on the level with a 4 to 1 gear and the more recent one was exhibited at the International Exhibition of 1862, where it took its place alongside the Ice Locomotive *Rurik* built by Messrs Neilson and Co., of Glasgow.

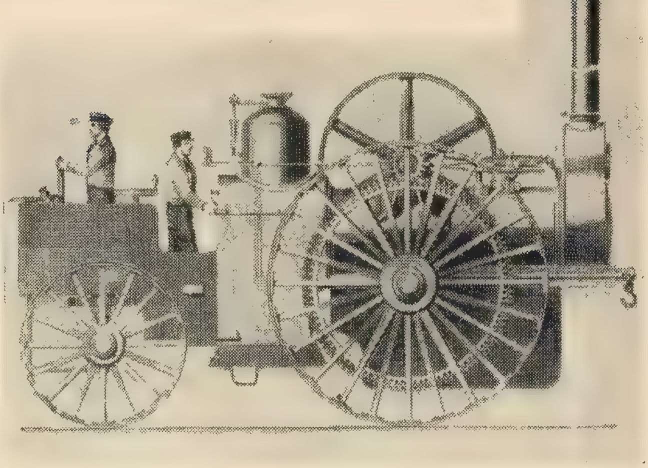
Between 1840 and 1860 the heavy traction engine for agricultural and haulage purposes had been developed with success in Great Britain, and it led to great improvements in agriculture. This development continued during the period 1861 to 1865 when numbers of engines were exported to other parts of the world.

But in spite of their recognised advantages and economy over horse haulage, traction engines were ill-favoured by horse owners and local government authorities; as an indirect result of which the famous "Red Flag Act" was passed in 1865 which reduced the speed of engines on the open road to 4 m.p.h. and forced them to be accompanied by at least three persons—one of whom was to precede the engine on foot at a distance of 60 yards. Nor could a road locomotive pass along a main road except between midnight and 6 a.m. Farmers were thus often compelled to work in the dark!

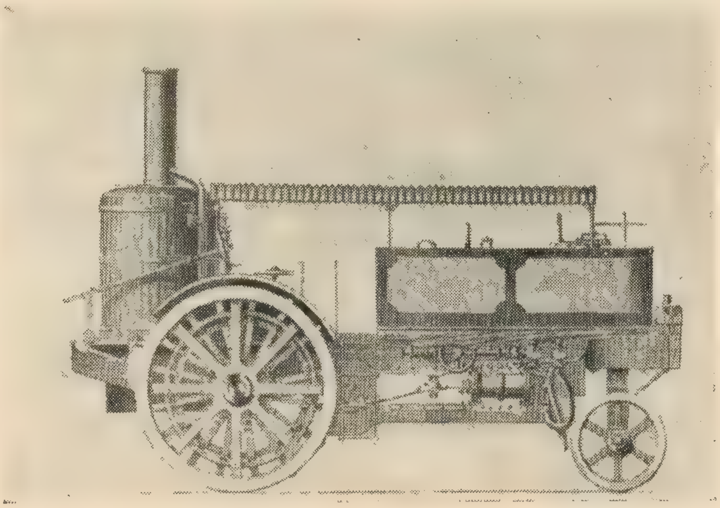
Although traction engines were in effect the only mechanically-propelled vehicles allowed on the roads of Great Britain, whatever the restrictions, they continued to develop.

In 1878 Thomas Aveling introduced a two-speed countershaft drive, and two years later the 2,000th traction engine rolled out of Aveling and Porter's famous Rochester works. In 1880 Edwin Foden commenced to use two-cylinder engines, so improving the torque and giving more even running, and the following year John Fowler pioneered the compound traction engine when he fitted a 10 h.p. unit working at 140 p.s.i. ■

*Two-cylinder, 16 h.p. traction engine with 4 to 1 gearing. It was built by Taplin of Lincoln,* 1862



*An Alexander Chapman traction engine of* 1861



# TURBINE BLADE CUTTING

**L. K. BLACKMORE outlines a method for the accurate machining of turbine blades**

THE FOLLOWING METHOD of producing the blading on turbine wheels was developed in connection with some experimental work being carried out on small gas turbines.

Turbine wheels up to $2\frac{1}{2}$ in. dia. may be produced with practically any desired blade form. Steam turbine blading of impulse section could be formed, as the blade length is not great and the design section could be maintained over the full length. Gas turbine blading which is much longer and which merges from a near impulse section at the blade root to a near reaction section at the tip can also be produced.

This attachment tends to cut this type of blade due to its action and this effect can be increased by displacing the centre line of the attachment and the template and/or the carrier slightly behind but parallel to the axis of the cutter, which in this case was the lathe centre line.

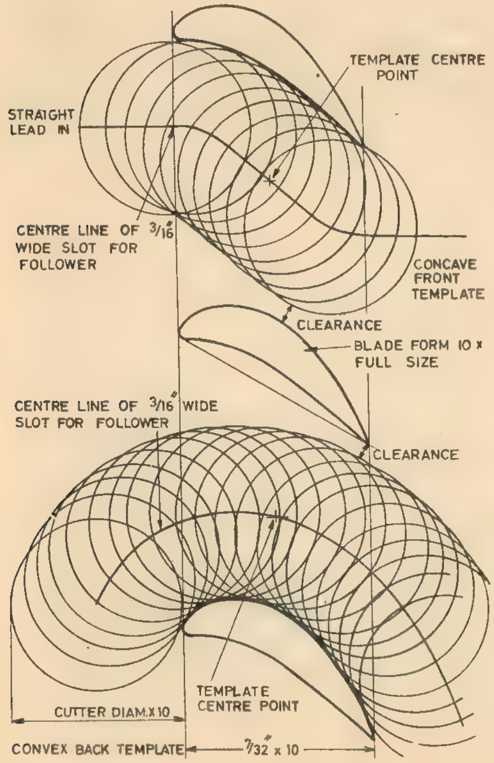
The attachment was designed to be mounted on the vertical slide of a $4\frac{1}{2}$ in. centre Hercus lathe but it can easily be adapted to fit practically any lathe or milling machine and provided basic principles are observed, made smaller or larger to suit particular cases.

An essential requirement is that the machine to which it is fitted must be rigid, as the heat resisting stainless steel used for gas turbine wheels is very tough. Cuts as heavy as possible have to be taken, as this type of steel work hardens rapidly.

The concave faces of the blades are cut first and the straight lead in on the template brings the cutter into the position where the blade form is being started. After these are all cut the template is changed and the convex faces are finished.

The blades are cut in one pass to the full depth due to the work hardening properties of the steel. No preliminary gashing is done. There must be a copious flow of cutting fluid sufficient to wash chips clear as soon as they are formed. The cooling and lubricating properties are also essential.

The cutters are made from annealed high-speed steel which is heat treated after machining the cutter. Silver steel has also been used successfully. They are made from $\frac{1}{2}$ in. dia. round, turned $\frac{3}{8}$ in. parallel to go into a $\frac{3}{8}$ in. collet. A collar, $\frac{1}{2}$ in. dia., is left which butts against the collet nose. This is essential to prevent the cutter working back under vibration. The cutter end is turned the desired angle and the four cutting edges are milled in.




**Turbine wheel design**

| | |
|---|---|
| Outer dia. ... | 1.9375 in. |
| Root dia. ... | 1.3125 in. |
| No of blades ... | 16 |
| Blade height ... | 0.3125 in. |
| Blade width ... | 7/32 in. |
| Design dia. ... | 1.7 in. |
| Blade pitch on design dia. ... | 0.334 in. |
| Cutter dia. 60 per cent. from the top ... ... | 0.2 in. |
| Cutter angle ... | 22.5 deg. |
| Cutter tip dia. ... | 0.12 in. |
| Cutter tip rad. | 0.04 in. |
| Distance from attachment axes to template ... ... | 9.687 in. |
| Template size ... | $7\frac{1}{2}$ in. x 4 in. x 16-gauge |

### Ten times full size

As there is a 10 to 1 ratio between the design radius of the turbine wheel and the distance from the axes of the gimbal to the template, the template is laid out 10 times full size and the $\frac{3}{16}$ in. slot cut in it in which the follower arm is traversed. The blading is thus cut to a high degree of accuracy.

The design radius referred to is the distance from the axis of the wheel to the part of the blade on which the design is made.

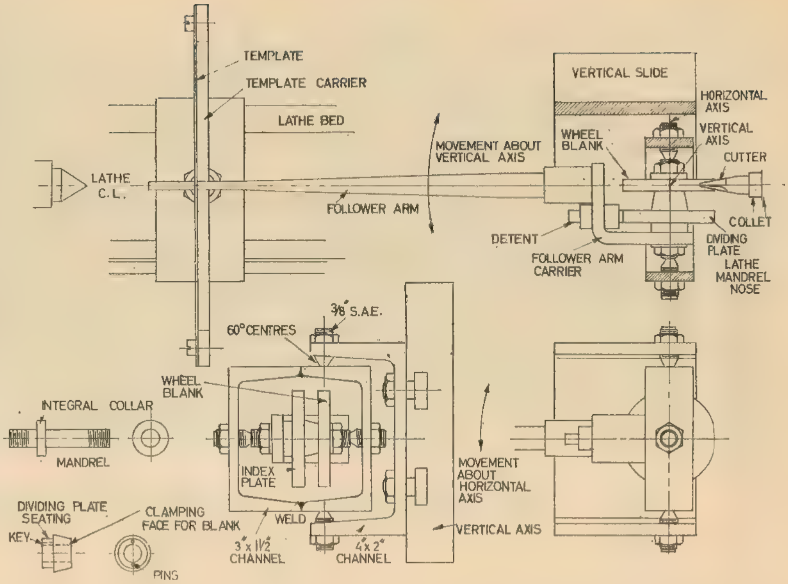
In small turbine wheels the most effective point of the blading is probably 66 per cent. of the distance from root to tip. When the trial set-up is being tested it may be found that a cutter with a greater included angle than estimated may be required due to the action of the blank movement.

Blades cut with this attachment have no tendency to be undercut at the roots so that maximum strength is maintained. Blade heat transfer to the disc is uninterrupted so that distribution of temperature over all the wheel is as even as possible. The

action of moving the blank over the revolving cutter produces a blade thicker at the root than the tip even if the included angle of the cutter is equal to the angular pitch of the blading.

Design of the wheel, blade shape and angle are carried out first, the templates cut and the attachment is then set up with an aluminium alloy blank, trial cuts made, and final adjustments done until satisfactory settings are found.

The attachment is basically a universal gimbal mounting, attached to the vertical slide, in which the turbine wheel blank may be moved about its own centre on a horizontal axis and a vertical axis which passes through its own centre. The wheel blank is mounted on a short mandrel together with a dividing plate and template follower arm carrier. These parts must be rigidly fixed on the mandrel.




### Changing the work

The wheel blank and the dividing plate are not disturbed throughout the process. The blank is positively located by two pins which fit into corresponding holes in the mounting collar and the blank. The holes are only drilled into the blank $\frac{1}{4}$ in. because as little metal as possible must be removed from the blank. The dividing plate is located by a well-fitting key.

On the mandrel on the opposite side of the integral collar, the inner end of the follower arm carrier is held by its own nut. This nut is loosened when another blade is to be indexed, the detent moved to the next position and the nut clamped up solid again. Thus the blank, index plate and follower arm become a solid unit with the mandrel during the actual cutting process.

Accurately cut lathe change wheels could be used for dividing, in which case extra width would have to be catered for on the mandrel.

The mounting frame of the unit is in this case a 4 in. × 2 in. channel section 3 in. long which is bolted to the vertical slide. It would be easy to base mount the unit if required, in which case the 60 deg. centres which it carries may provide the vertical adjustment.

On these centres is carried the universal gimbal which is made from two pieces of 3 in. × $1\frac{1}{2}$ in. channel section 1 in. long which are welded together. The centres which carry the short mandrel are carried in this box section and the whole then allows freedom of movement in all directions.

The template carrier is a U-shaped frame bent up from $\frac{3}{8}$ in. × $\frac{1}{4}$ in. steel and is mounted on a base which clamps on to the lathe bed and can thus be adjusted lengthways to bring the template to the correct distance from the attachment axes.

The carrier must also be capable of both horizontal and vertical adjustment to bring the design centre of the template to the correct position. If the mounting holes in the template are slotted horizontally it will provide sufficient movement in that direction.

Vertical adjustment can be arranged by welding a short piece of $1\frac{1}{2}$ in. channel steel upright on the base. A piece of $\frac{3}{8}$ in. × $1\frac{1}{4}$ in. steel is welded to the U-carrier which fits within the channel. The two parts are then held together by a bolt which goes through both pieces, in one of which is a slotted hole.

The example of a turbine wheel design given is purely to show the method of laying out the template, etc., and does not necessarily represent a proved design. The three blade sections at the design radius are drawn at 10 times scale so that the two template slot centre lines may be drawn.

The cutter diameter is arrived at at this stage when it can be seen what is the maximum diameter that can be accommodated without interference with the adjacent blade. Circles representing the cutter diameter at this point are then drawn just touching the blade section and about $\frac{1}{4}$ in. apart.

The centres on which these circles are drawn are then joined to give the centre line for the template pattern. This is then transferred to 16-gauge steel $7\frac{1}{2}$ in. × 4 in. and a series of 5/32 in. holes drilled the length of the slot, the intervening metal removed and the slot filed out to the $\frac{3}{16}$ in. width.

At the laying out stage the horizontal and vertical centre lines of the templates are deeply scribed in the plates to assist in setting up the template in its correct position.

The description and drawings are of an explanatory nature only, and no working drawings have been made because applications would vary a great deal depending on what machine it was to be used with.

The drawings given are to scale for a Hercus $4\frac{1}{2}$ in. lathe which is the Australian version of South Bend, an extremely rigid and accurate machine.

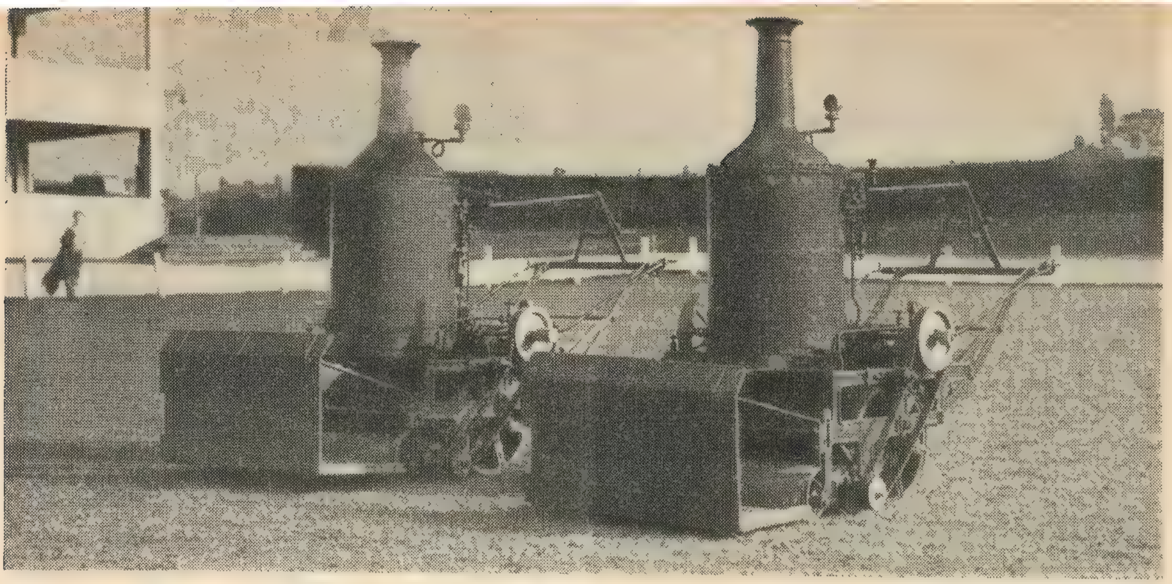
A lot of detail is not shown deliberately as it was felt more important to make basic principles clear. It would not be very difficult to make an attachment to suit the Myford which would cut wheels up to 2 in. dia. ■

### FOR SHIP MODELLERS

John N. C. Lewis, in *Ship Modeller's Logbook*, has produced the ideal book for the enthusiast. He shows the reader how to make simple, decorative, miniature and scenic models, including a clipper ship in a bottle and an Arabian Baggala.

There are details of clench and carvel built models, and the text is enlivened by stories of eighteenth century smuggling and the work of the Revenue Cutters.

Obtainable from Percival Marshall and Co. Ltd, price 12s. 6d., postage 1s. (U.S.A. and Canada $3.00).



# A steam lawn mower

**By J. Holding**

TO PERPETUATE the early days and their subsequent progress Leyland Motors are creating a museum.

They needed a steam lawn mower and the only one in existence was in Reading Museum. This was kindly loaned to Leyland Motors to copy.

The replica was built in the Apprentice Training Centre. As a pensioned shop foreman, I was requested to supervise this. I started in steam 55 years ago. I am finishing up with my first love after 41 years of petrol and diesel.

The original was dismantled, and the parts used as patterns. Old-time moulders, who could cast from old parts, did their bit, and the result is quite good.

### LAWN MOWER BOILER

This is a vertical firetube boiler 3 ft 7 in. × 1 ft 8 in. with about 50 1¼ in. vertical copper tubes. Firebox is of copper.

The internal parts, comprising firebox, tubes and top cover can be lifted out of the outer shell for cleaning.

Half-inch bolts secure top and bottom, and there are asbestos joints between top and bottom flanges. The smokebox is sheet metal, the chimney riveted, and the cover is secured to the boiler by four clips to the boiler flange. Heat is supplied by a paraffin burner.

This receives fuel from a copper tank fitted across the front of the mower frame, pressure being applied by air pump, worked by hand to start, then power-driven from an eccentric on the engine crankshaft.

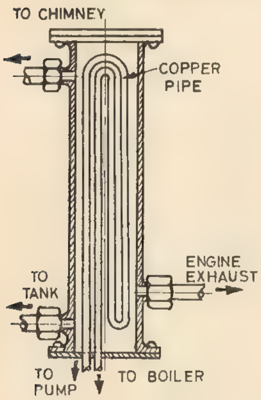
One half of the copper tank carries water to supply the boiler. A pump, again driven by an eccentric, feeds the boiler. This is a plunger pump of ⅝ in. dia. and about 3 in. stroke.

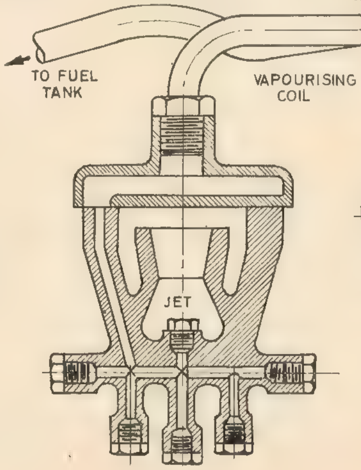
An interesting feature is the condenser water head seen on the left hand of the boiler. Exhaust goes into a container, inside which is a coiled copper pipe. This is connected to the feed pump and thus water is pumped through, while exhaust steam surrounds this tube and heats the feed water. The condensed steam runs back to the tank.

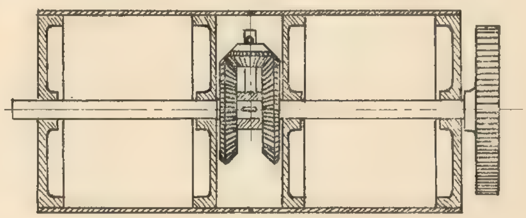
### LAWN MOWER ENGINE

This is two-cylinder compound

*At top: The original steam lawn mower and the replica (left) built by Leyland Motors apprentices. Below: Details of the condenser, paraffin jet burner and the differential gearing*



steam engine, approximately 4 in. and 2 in. bore × 6 in. stroke. It has D-slide-valves, open front T-section crosshead slides, forged connecting rod, with jaws at the crosshead end, and marine bolted at the crankpin end.

The crankshaft is built up of cast webs. The shafts, $1\frac{1}{4}$ in. dia., are pressed in the webs and held by grub-screws fitted half in the webs and half in the shaft.

The bedplate is cast iron, box pattern, concave at the back to fit on the boiler shell, being secured to the boiler by two $\frac{5}{8}$ in. studs at the top and by three $\frac{1}{2}$ in. studs to the bottom of the boiler angle-iron carrier bracket.

Pressure maintained by the boiler was 150 p.s.i. Lubrication of the engine was by oil nipples to all moving parts. The cylinders are oiled by old two-tap type lubricators. The method is to close one tap at the cylinder end, open the top tap, fill with oil, close the top tap and then the bottom tap.

The low-pressure piston has two cast-iron rings; the high-pressure has two grooves packed with greased gland-type packing.

This engine was found at Repton College and installed in the replica mower made for Leyland Motors Museum.

The frame of the mower is composed by two cast-iron frames, no machining being needed except drilling.

The roller is composed of four cast-iron discs, two of which have bevel gears cast on to form differential. The outer shell is of sheet metal riveted to the discs.

The differential is carried by $1\frac{1}{4}$ in. shaft running in brass bushed brackets. A gear wheel fitted on this shaft is driven by means of a dog-driven gear on the crankshaft through an intermediate gear.

At the front end of the machine are three rollers about 7 in. dia. made of cast-iron discs with sheet metal covers. They run in brackets and are adjustable to regulate the cut, exactly as present-day hand mowers operate.

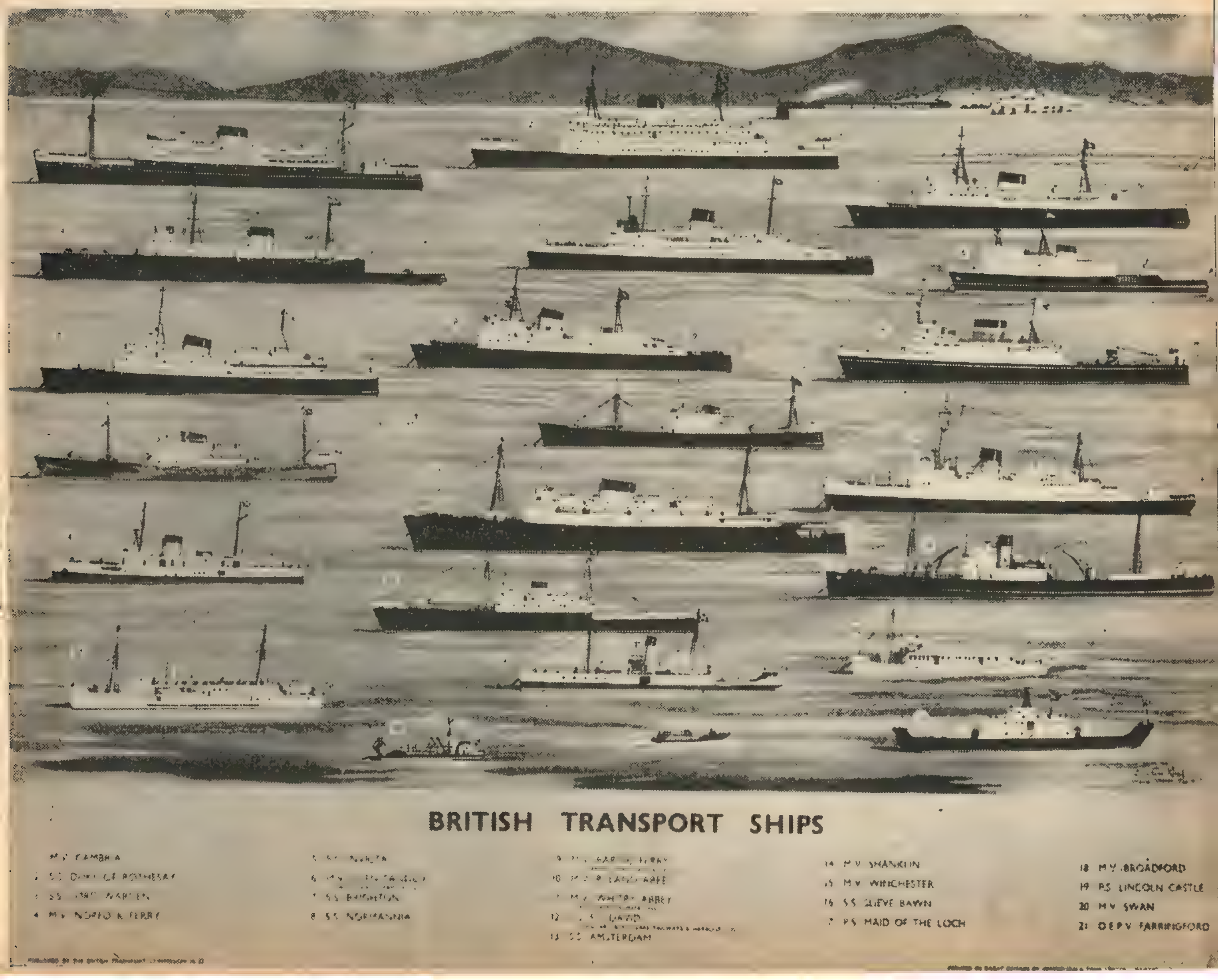
The cutter is of modern type. There are six discs set on a $1\frac{1}{8}$ in. shaft with steel blades fitted as a helix. The fixed blade is screwed to a cross member across the frame. The rotor cutter is driven by chain direct from the crankshaft through a dog clutch.

There are two forged handles attached to the frame for guiding the machine, one lever each side operating the dog clutch. Steam-control valve is by crank lever in front, about chest height. A toolbox is fixed in the front. ■

## BRITISH RAILWAYS SHIP POSTER

**SHIP modellers will be interested in a new poster issued by the British Transport Commission which depicts, in review fashion, 21 vessels owned or operated by the Commission.**

**Copies are obtainable from the Chief Publicity Officer, British Transport Commission, 222, Marylebone Road, London, N.W.1, for 5s.**



# VIRGINIA

*Continued from 17 January 1957, pages 98-100*

**In this instalment L.B.S.C. gives instructions for erecting both larger and smaller boilers and fitting the pipework**

As BOTH ancient and modern boilers are erected in similar manner there will be no need to separate the instructions, so I will just point out the difference in the attachment of the smokeboxes to the boiler barrels.

The smokebox on the smaller boiler is $\frac{1}{4}$ in. less in diameter than the boiler barrel. In full-size practice they were actually the same diameter, but the apparent extra size of the boiler barrel was explained by the fact that the boiler was lagged—not the smokebox, the lagging making up the extra diameter as can be seen from the outside.

On the more modern boilers the smokebox was made to the diameter of boiler over the cleading plates, which American enginemen call the "boiler jacket." This brought the smokebox apparently flush with the barrel. As the only lagging needed by the small engine is a bit of thin sheet metal over the firebox wrapper, to hide up the stayheads, I specified the actual boiler barrels to be full diameter and this calls for a different method of attachment to that used on the full-size job.

This is really an advantage, as the smokeboxes are easily detachable, which is more than can be said for the full-size articles !

The smokebox on the smaller boiler fits inside the end of the barrel, the difference in the outside diameter of the smokebox and inside of barrel being filled up by a brass ring. This should be $\frac{1}{2}$ in. wide and $\frac{1}{16}$ in. thick.

If a piece of 16-gauge tube $3\frac{5}{8}$ in. outside dia. is available, chuck it in the three-jaw with a wood disc or something solid inside to take the jaw pressure and prevent its collapsing, then face the end and round it off for about $\frac{1}{8}$ in. Part off at $\frac{1}{2}$ in. from the end.

Put a smear of plumbers' jointing around the inside of the barrel and press in the ring, leaving the rounded-off end just projecting. This will represent the polished brass lagging-band which was a conspicuous feature of *Virginia's* ancestors. They were a gay lot of lassies with their polished brass and steel, colourful painting, and ornamentation, in striking contrast to the sombre and funereal plain black which was adopted in later years.

However, history is repeating itself; some of the American diesel locomotives are inclined to be gaudy !

If the ring is a tight fit it will require no further fixing, but if slack enough to slide, four small countersunk screws put through the boiler-barrel and ring will hold it. Put another taste of the plumbers' best friend around the inside of the ring and press in the smokebox to about $\frac{3}{8}$ in. depth. Be sure to have the smokestack dead in line with the dome so that it will stand quite vertically when the boiler is on the frames.

A similar ring is fitted to the end of the larger boiler barrel, but this does not need to be rounded off and is only pressed into the barrel for half its length. Fix by screws as above if slack, then smear some of the jointing paste on the outside and press the smokebox over it, taking the same strict caution to have the stack vertical.

The ends of the barrel and smokebox should butt up flush, the joint being covered by an ordinary flat and narrow boiler-band of the usual type when the job is finished off. If brass tube is not available to make the joint rings, they can be rolled up from strip brass of 16-gauge and the joint butted and silver-soldered.

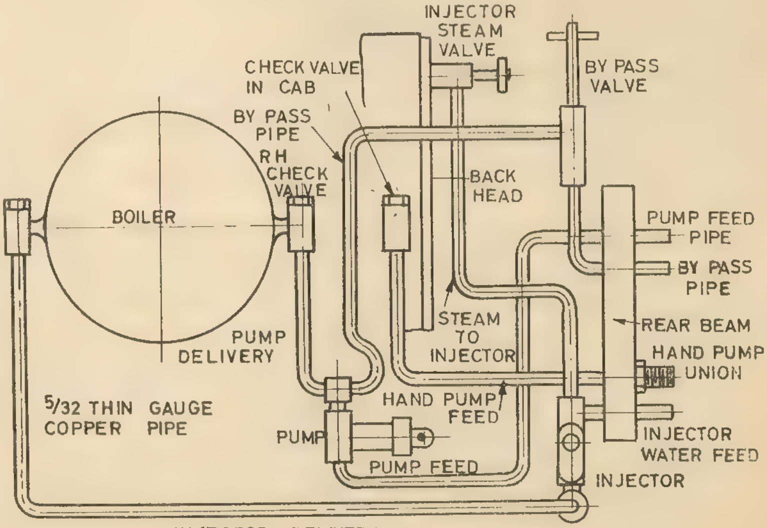
Tip to beginners—fit the strip ring to the barrel before silver-soldering to ensure an exact tight fit, then pull it out and get busy with the blowpipe, putting the butt piece on the inside (it need not be more than $\frac{1}{2}$ in. long) and fixing it with a couple of $\frac{1}{16}$ in. rivets. File the outside smooth after silver-soldering.

## HOW TO ERECT BOILER

If the smokebox saddle has not yet been fitted to the chassis, do this now, lining it up with the cylinders and attaching it to the top of the frame by screws as shown in the drawings.

Before fixing it permanently, drill four No 41 holes through the top of the flange at each side about $\frac{1}{8}$ in. from the edge for screws to hold the

*Diagram of the pipe connections*



smokebox to the saddle. Take off the blast nozzle and the steam-pipe union and put the complete boiler and smokebox in place with the steam and exhaust pipes going through their respective holes in the bottom of the smokebox.

The firebox should just clear the trailing axleboxes nicely and leave plenty of room for the pump eccentric-strap to clear the throatplate on the back dead centre. There should be just room enough for the boiler to sit level without fouling the springs at each side of the frame.

Pack up the barrel at the throatplate end with a piece of wood placed across the frame top and adjust until the bottom of the boiler barrel is exactly level and parallel to the top edges of the frames.

On full-size engines the rear ends of the boilers were supported by two cantilever-like beams attached to the backhead and frames, and lifting was prevented by two brackets at each side of the firebox wrapper ahead of and behind the support of the equalising lever. They embraced the top bar of the frame and were attached to the wrapper by studs and nuts.

We don't need anything so elaborate as that for the little engine. All that will be required are two plain brackets, one on either side, at the rear of the equaliser support. They can be made from commercial brass angle or bent up in the bench vice from 13-gauge sheet brass to the size given in the drawing, and drilled as shown.

With the boiler in position as mentioned above, put a bracket on top of the frame, close to the equaliser support, with the drilled side against the boiler. Run the drill through the holes in the bracket and make counter-sinks on the wrapper sheet, remove bracket, drill the holes No 48, tap 3/32 in. or 3/48 and fit screws.

These should be home made from drawn bronze rod, as I mentioned in a previous note. When both brackets are screwed on lift off the boiler and sweat over brackets and screws with solder, same as stayheads, which is the best insurance against leakage that you could wish for.

To prevent the boiler lifting, and at the same time allowing it freedom for expansion—very important that!—fit a couple of clips made from angle or bent from sheet metal. These simulate the frame clips on the full-size engines. The horizontal part of the angle rests on the boiler bracket but doesn't grip it tightly enough to prevent the boiler moving under expansion.

The vertical part of the clip is attached to the frame by a couple of 3/32 in. or 3/48 in. screws as shown. The smokebox is attached to the saddle by similar-size screws with round heads put through the clearing holes already drilled in the saddle flange into tapped holes in the barrel of the smokebox. Don't bother about connecting up the pipes inside the smokebox for the time being in case there should be any need to lift the boiler while doing the "plumbing."

## FITTING THE WATER PIPES

Although our water pipes must of necessity be much larger than "scale" size, which would be useless, there is no need to fit them so that they look clumsy. I am including what our radio and television friends would call a "schematic diagram" of the whole outfit; and as long as the pipes start and finish at the right places their exact location will not affect the working of the engine in any way, so neatness is the watchword.

The right-hand check-valve on the boiler barrel takes the feed from the pump, so all that is required for that will be a piece of 5/32 in. copper tube with a union nut and cone at each end. To get the exact length, measure with a piece of thick lead wire which is easily bent to the shape of the pipe. When straightened out, it will give the exact length to which the actual copper pipe will be cut.

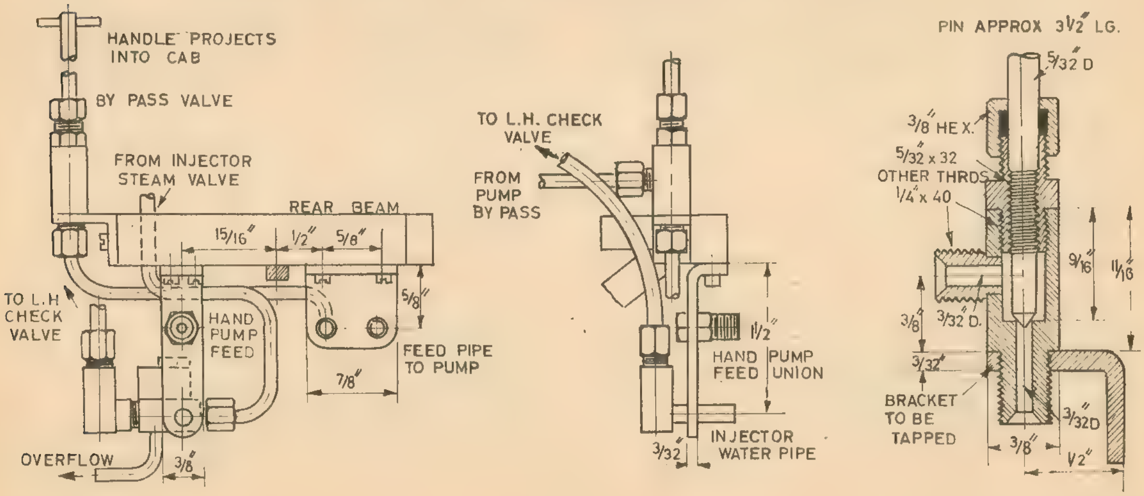
When silver soldering on the cones make the whole length of pipe red hot and quench the lot in the acid pickle, rinsing away all traces of the pickle under the kitchen tap; then rub it with a bunch of steel wool and the result will be a delight, just like the old American enginemen liked to see their pipe work.

Bend to shape with finger-pressure only; don't use pliers or any other kind of grip or the pristine beauty of the pipe will be completely destroyed. Anybody of average strength can bend 5/32 in. pipes without effort. These remarks apply to the whole of the pipe-fitting. The lower end of the above-mentioned pipe is attached to the front union on the pump delivery tee.

The back union is connected to the bypass valve by a long pipe which is brought out over the left-hand frame and runs along to the bypass valve which is attached to the frame at the rear end. This pipe should be set at approximately $1\frac{5}{8}$ in. above the top of the frame so that it will lie under the running-board when same is erected.

The delivery pipe from the injector keeps it company until it turns in-

*Arrangement of pipes at rear beam and sectionalised view of the bypass valve*



# VIRGINIA

***continued . . .***

wards to the pump, while the injector pipe goes on in the shape of an inverted swan-neck and is connected to the left-hand check-valve, as can be seen in the general arrangement of the engine published with the first instalment.

The injector itself is supported by the water-pipe passing through a hole in a sheet-metal bracket screwed to the underside of the rear beam. The full-size engines had their pipes suspended by long hanging pipe-clips; again, these would be useless on the little engine; much too fragile.

The steam-pipe to the injector is also 5/32 in. dia. and runs from the bottom union on the injector steam-valve to a little below frame level where it is bent into a half-circle and connected to the steam inlet on the injector by a union nut. Note, a plain collar, not a cone, is needed on this end of the pipe to butt against the end of the steam cone.

The feedpipe to the water-pump and the pipe from the bottom of the bypass valve are supported by another sheet-metal bracket at the right-hand end of the drag beam. The feedpipe can be run along under the right-hand frame and then bent inwards to connect to the union at the bottom of the valve-box.

A small clip can be bent up from ¼ in. strip metal and attached to the underside of frame, about half-way along, to prevent the pipe from sagging. Keep it clear of the ashpan, so that the latter is free to drop.

As the bypass valve is made in exactly the same way as the other screwdown valves there is no need to go through the whole ritual again, the sectional drawing giving all the necessary dimensions. For the sake of clarity I have shown both the bracket and the union nipple at the side, in the same plane in the section, but actually they are set at right angles, as is plainly indicated in the drawing showing the arrangement of pipes at the rear beam.

The bottom union is made a little longer than usual, the hole in the bracket tapped ¼ in. × 40, and the union nipple screwed into it, which dispenses with a separate locknut, as space is rather at a premium at this point. Be careful to avoid kinking the pipe from the bottom union to the bracket under the beam when bending it.

Another tip to beginners—soft lead wire can be purchased in various gauges from 1/16 in. upwards (I keep a stock of several sizes) and if a piece is poked through the pipe before bending, bends of quite small radius can be made without any danger of kinking.

You can't pull out the wire, naturally, after making the bends but if you make the pipe red hot the wire melts and runs out of its own free will and accord, and usually with great alacrity ! This tip doesn't seem to be generally known.

Contrary to the way I arrange the connecting pipes between engine and tender on British locomotives, the injector feed is set low down, which is beneficial to that gadget as it keeps cool and starts as soon as water and steam are turned on. The union for connecting up the feedpipe for the emergency hand-pump is placed directly above it.

A union is needed here as the pipe is under pressure when the pump is operated; the other connections are not under pressure and slip-on hoses will suffice. Chuck a piece of ⅜ in. hexagon rod, face, centre deeply and drill to 1 in. depth with No 41 or 3/32 in. drill. Turn down a full ⅜ in. of the outside to ¼ in. dia. and screw ¼ in. × 40. Part off at ⅝ in. from shoulder, reverse in chuck, turn down ¼ in. length to ¼ in. dia. and screw ¼ in. × 26.

The coarser thread is more handy for coupling up the tender pipe. Countersink the end, and chamfer the corners of the hexagon. Make a ¼ in. × 40 locknut and union nut from the same sized hexagon rod. Put the longer end of the double union through the bracket, secure with the locknut, then connect it up to the check valve at the side of the wrapper sheet inside the cab with a 5/32 in. pipe furnished with union nuts and cones at each end.

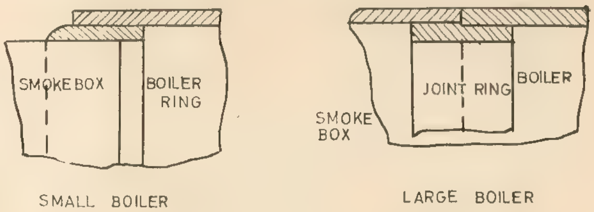
If the plumbing job has gone off O.K. without having to take off the boiler any more, the connections in the smokebox can now be finished off, coupling up the swan-neck from the superheater to the vertical steam-pipe and fitting the bottom of the snifting-valve into the hole provided.

See that the blower ring sits well down on top of the blast nozzle so that the steam from the jets all goes up the stack, and line up the nozzle itself by putting a straight piece of drill-rod down it, which should be a good fit in the hole in the nozzle, bending the blastpipe, if required, until the piece of drill-rod stands up exactly in the middle of the stack.

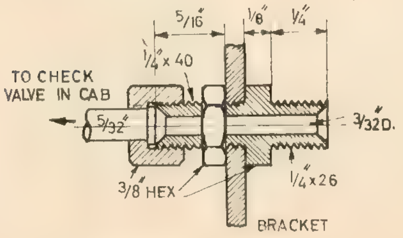
Make quite certain that the unions are tight, because if any steam escapes into the smokebox it will destroy the vacuum and the boiler won't steam. By the same token, as Pat would remark, the holes where the pipes pass through the smokebox barrel must be sealed so that no air can be drawn in.

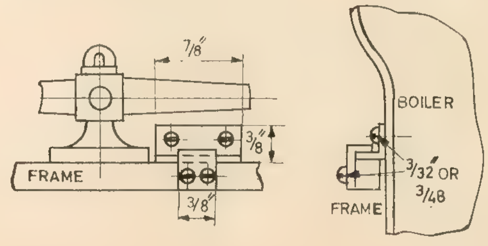
● *Continued on page 184.*

*Right: Showing the joint between the boiler and smokebox and the boiler expansion bracket*

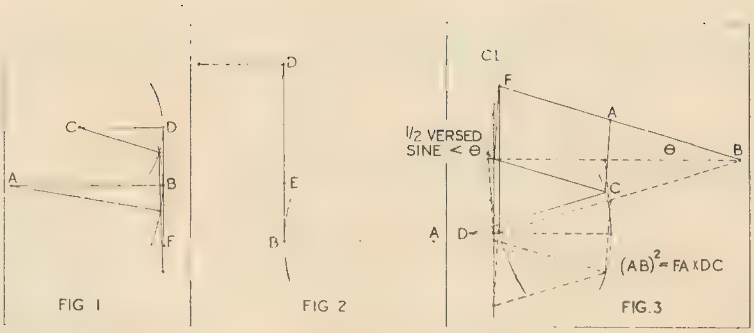



*Below: The union fitting for the hand pump feed*



# Watt's parallel motions




***Two of the parallel motions invented by Watt are well known, but there is a third about which F. J. LEWITT writes***

THE NOTES on Watt's parallel motions [MODEL ENGINEER, October 4, page 495] mention two aspects. There is, however, a third straight-line motion for which Watt was responsible. This third type is not often met with; in fact during the 50 years that I have been a reader of MODEL ENGINEER I have seen references to it only twice.

On the first occasion an article by Student in the issue for 25 February 1954 showed a photograph of a small beam engine fitted with this particular motion. No reference was made to the motion other than that it was of an uncommon type, so it is possible that Student had not appreciated the rarity of his find.

On the second occasion the article on historical models by Hallam [M.E. 30 December 1954] showed on page 761 a photograph of a rolling mill engine fitted with Watt's "third" motion. Hallam, however, refers to it as Watt's "first" but here I think he is mistaken, as it is listed as No 3 in Muirhead's book of Watt's patents.

### Not a parallelogram

It is unfortunate that neither of the photographs above-mentioned showed the details of the linkage very clearly.

Readers referring to Student's article may get the impression from a cursory glance that the linkage above the beam forms a parallelogram, but such is not the case as the inner end of the horizontal link is hinged to a vertical rod bolted to a lug on the main column. Its outer end is coupled by means of a vertical link to both the end of the beam and the crosshead.

Laid out diagramatically, the linkage is as shown in Fig. 1. *AB* represents the right half of the beam, *A* being the main trunnion, and *CD* the horizontal link pivoted at *C*. *D* and *B* are coupled by a vertical link extended to point *E*, to which the crosshead is attached. Since the arcs described by *D* and *B* are of different radii the point *E* is constrainted to move in a straight line within limits, provided the links are correctly proportioned. The correct proportions are given by the equation $\frac{EB}{ED} = \frac{CD}{AB}$

### Three bar motion

It may be observed that if we consider the linkage to be made up of two units, *ABE* and *CDE*, and we swing the former anti-clockwise through 180 deg. using *E* as the pivotal point, we arrive at the three bar motion shown on page 495 (see also Fig. 2) but with the difference that the two beams *AB* and *CD* are now of different lengths. The equation given above, however, still applies.

Beam engines fitted with Watt's third type of parallel motion are very rare but anyone visiting Edinburgh will find a glass case working model in the museum there.

If B.M.V. is contemplating building a beam engine perhaps I may be allowed to point out that it is usual to fix the cylinder centre line not exactly in line with the extremity of the arc described by point *F* but a short distance to the right of it sufficient to cause link *FG* to oscillate equally to right and left of the centre line. The exact amount of offset, which may easily be calculated and expressed mathematically, is half the versed sine of the arc described by the gudgeon pin at the end of the beam (see Fig. 3).

This offset applies to all three of Watt's motions and in the case of the three bar motion on page 495 bringing *B* and *D* closer together to give the correct angle of inclination to *AC* will actually increase the length of the straight line limits of *E*, that is with *AB* and *CD* of given lengths.

It is a regrettable feature of many show case beam engines that the amount of offset of the cylinder centre line is incorrect. Engines may be beautifully made and highly finished but to anyone having a little knowledge of beam engine proportions the fault sticks out a mile.

### Worst offenders

But the worst offenders in my experience are the model side-lever marine engines. One can take it, I suppose, that the prototypes functioned all right but many of the models certainly do not and one in particular, which I saw on the other side of the Border, had me quite mystified as the two ends of one member of the parallel motion were trying to move in opposite directions at the same time!

I asked the curator if I might be allowed to examine this model as there appeared to be something not quite right. He agreed, but received a shock when we found that nearly every bearing bolt and pin connection in the motion work had been left sloppy (slack is too nice a word in this case) to enable the job to work at all.

Anyone sufficiently interested in Watt's parallel motions will find them all described in Muirhead's *Patents of James Watt* published about 100 years ago. ■

# The bushing-type fixed steady

**MARTIN CLEEVE discusses a self-centring steady for work up to 2 in. diameter**

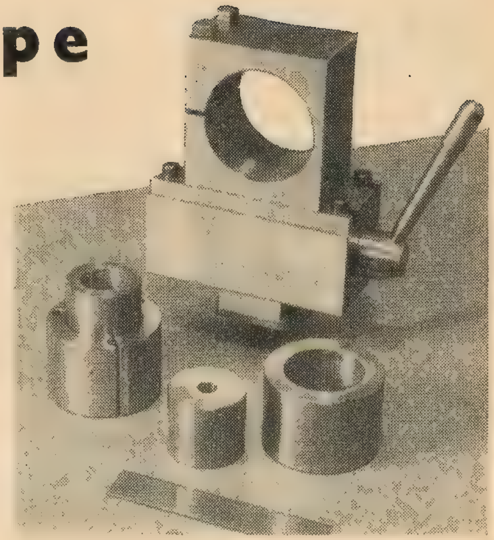


*Fig. 1: The steady with interchangeable bushings and economiser. The rule in foreground is 4 in.*

DURING THE WAR I had the task of machining a number of five-step spindles from $\frac{3}{4}$ in. dia. bright mild steel for electric motors. The material was supplied in the form of 15 ft bars.

The lathe then in use was a Myford ML4, and as the clearance hole through the headstock spindle was only suitable for diameters up to $\frac{3}{8}$ in. it was not possible to part the stock to length in the customary way by passing it through the lathe spindle and up to a length stop. In those days I did not own a power hacksaw and until another expedient was hit upon it seemed as though I was in for a goodly hand sawing session.

It so happened that the tailstock body of the ML4 has a bore of $\frac{3}{4}$ in. for the barrel, so the barrel was removed, and the body used as a fixed steady bearing. At the time, I was working in a wooden shed in the garden. To accommodate the initial 15 ft length of the bar stock I had to drill a hole in the shed wall in line with the centre line of the lathe !

By passing the stock through the hole in the wall, through an additional anti-whip bush (of wood) held in a bench vice, and through the tailstock up to a stop held in the morse taper of the lathe spindle nose, ample support was given during parting, which was arranged to take place close to the tailstock body.

Subsequent work of a similar nature on $\frac{5}{8}$ in. dia. bright bar was handled by bushing the tailstock barrel bore. Later, I had a job which necessitated parting off the supporting centre hole of a quantity of turned mild-steel components of $1\frac{1}{8}$ in. dia., but of a length too great to permit parting by holding in the chuck alone.

Having no faith in the ability of the tips of the normal three-point type fixed steady to resist the wear of a rotating shaft and maintain their adjustment for more than a few minutes at a time, I managed to fix a bushing at centre height by packing it up with sundry mild-steel offcuts, blocks, bolts and clips, the bushing being inserted in a piece of $1\frac{1}{2}$ in. square stock.

With this type of support it was such a pleasure to take the parting cuts that I was sorry when the job came to an end. Not only was chatter eliminated under normal parting conditions, but it was impossible to provoke chatter; upon trying to do so, as by increasing or decreasing the feed slowly or suddenly above and below the usual single permissible satisfactory rate, the tool merely either cut or did not.

**Adaptation for ML7**

In the light of these varied and gratifying experiences (all on the Myford ML4) I thought it a good idea to make up a more universal and easily mounted steady with interchangeable bushings and as large a range as reasonably possible.

It will not be necessary to weary the reader with the intermediate designs so we may as well go straight to the latest which is shown in the photograph, Fig. 1.

This particular steady was made to suit the Myford ML7, and is locked to the bed in a manner similar to that adopted for the tailstocks of those machines. The hole in the split housing has a diameter of $2\frac{1}{4}$ in. and will therefore accommodate the largest bushing with a bore of 2 in.

At first sight it may seem that an enormous number of bushings would be required. I have found that this is not so. The more readily obtainable sizes of bright round bar increase in size by increments of $\frac{1}{8}$ in. at a time: moreover, there is little point in trying to obtain or to stock intermediate sizes the usefulness of which would be very limited.

Similar remarks apply to sizes over $1\frac{1}{4}$ in. dia.; here, jumps of $\frac{1}{4}$ in. are reasonable enough. Thus, for ordinary purposes, a set of only 10 bushings will serve: $\frac{1}{2}$ in. to $1\frac{1}{4}$ in. in increments of $\frac{1}{8}$ in. (seven bushes) and $1\frac{1}{2}$ in. to 2 in. in increments of $\frac{1}{4}$ in. (three bushes).

The last three bushings take the form of that shown at the foot of Fig. 1, right, with the exception that the 2 in. bushing, having a wall thickness of only $\frac{1}{8}$ in., is fitted directly into the main housing. Sizes below $1\frac{1}{2}$ in. are arranged to fit into an "economiser."

This may be seen at the left-hand side of Fig. 1, where it is shown with one of the smaller bushings partly inserted. It will be seen that without this economiser all bushings would have to be made from solid bearing metal of $2\frac{1}{4}$ in. dia., or be housed in mild-steel bushings of that size.

In the main, the purchase of special material for the bearings will not be necessary. Most of mine have been made from worn and discarded bearings. It is often possible to rebore an old bush so that it will serve for the next nominal size. Another mode of treating a second-hand bush that has not worn too badly is to under-bore the mild-steel case so that when the bush is forced in it closes down to the desired bore diameter.

In those cases where there is a free choice of material I should recommend cast iron as being the best for the purpose. The outer surface of bright steel stock is not always so smooth as might be desired and is not therefore so kind in its action on these bushings.

To meet one special case where a $\frac{1}{2}$ in. bush was receiving more than the usual occasional use, I prepared

it from silver steel and hardened it. Another time, when a special size was required to hold an odd sized piece of axle steel for parting off the end which was twisted and broken in such a way that it was impossible to give tailstock support, I made a bush from mild steel.

As my original ML4 lathe used to chatter on chuck work, and work to which tailstock support could not be given, I did not attempt to make bushes in the customary way whereby the inside is bored and the outside turned to diameter at one chucking. Strangely enough, it did not chatter on boring (or facing) but only on turning an external parallel surface.

**Not wasteful**

In view of this, the method I invariably adopted was to face and bore an oversize piece of stock of just sufficient size to clean up to finished length, and finish the outside diameter while mounted upon a truly running mandrel held between chuck and tailstock centre.

This not only produced a concentric bush without fear of chatter spoiling the final sizing cut, but it had the merit of not wasting the usual extra little bit of metal "for chucking purposes."

The nominal bore of the economiser is 1½ in. I actually made mine about 25 thou. under this size so that 1½ in. dia. stock could be used for the secondary economiser housings, leaving the odd 25 thou. to be removed as a final truing cut after boring and pressing in the bush.

## CONSTRUCTIONAL DETAILS

These are very similar to those already described for the milling arbor steady (MODEL ENGINEER, 23 August 1956) with the exception that the base block is wider, the intermediate base thinner and the main housing block considerably larger. The eccentric clamping mechanism is the same but, of course, the eccentric spindle is of greater length.

The housing block is 3 in. tall, 2⅞ in. wide and 1¾ in. "thick." At the time of making I had not got a 6 in. chuck so in order to hold the block for boring the large hole I drilled and tapped a ¼ in. B.S.F. hole in each corner and secured it to the faceplate with the interposition of $\frac{3}{16}$ in. or ¼ in. spacing pieces to bring it forward and give rear clearance for the boring tool. Upon completing the bore these holes were plugged by tightly screwing in ¼ in. screws, sawing off the heads and taking a light facing cut.

For the benefit of those who may be using the V-type of lathe bed, such as that illustrated in Fig. 3, I have included in Fig. 2 a modified fixing to suit. It should be noted that this does not necessarily mean that the base block has to be of even greater length than for the ML7: the bed of this lathe is 4½ in. wide, but the V-bed of the ML4 illustrated in Fig. 3 is only about 3 in. if I remember correctly.

Unfortunately the appearance of the fixing is hidden in the photograph, but this is interesting in other respects as it shows the fixed steady in use supporting a piece of 1½ in. dia. mild steel for the parting of a usable-size disc without tailstock support.

The practical limit to the size, depth and speed of cuts which may be taken when work is supported in this manner is determined only by the power available and the efficiency of the belting arrangements.

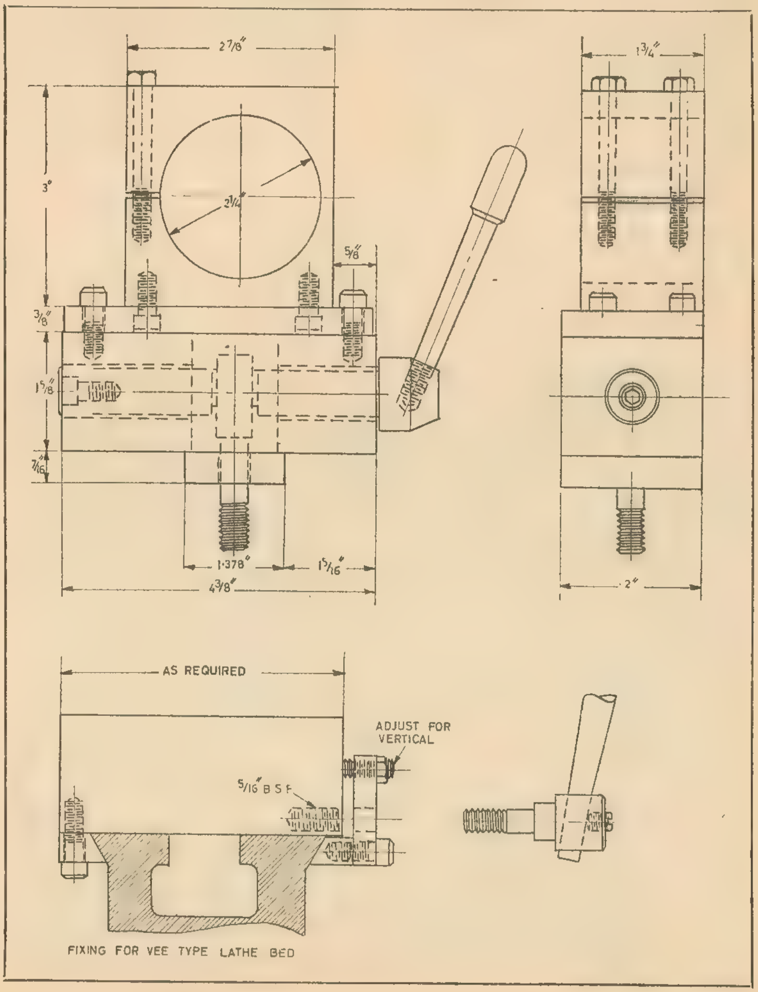
Before working upon bright stock it should be wiped clean with a paraffin rag, dried and oiled with a fairly thick lubricant at the point of support.

For work similar to that shown in Fig. 3, the fit of the bush need not be meticulously close; indeed it is not always possible to make it so as some bright stock is from 1½ to 2½ thou. under nominal size. It will be found, in practice, that where there is a little slackness, the work will tuck itself up into one corner (so to speak) and, with heavy oil, behave quite nicely. A parting cut such as that shown may be taken at 500 r.p.m. and the piece severed in a matter of a few moments.

In those cases where a precision component is being worked upon, such as a lathe spindle, I always make a special bushing with a good close running fit. The small extra trouble entailed by this has been found to be well worth while, especially where a dead concentric internal Morse taper has to be machined.

Examples of this kind of work have already appeared in some of my

*Fig. 2: General arrangement of the bushing fixed steady for the ML7*



previous notes but in those cases it was more convenient to use the smaller milling arbor steady as the work was often of 1 in. dia. and the bushing of that steady is adjustable, by compression, to the desired close fit.

Perhaps it should be mentioned that this larger version is not fully suitable for use as a milling and slitting saw arbor steady because the increased size of the main bearing housing block would restrict the forward movement of the stock being cut. If the larger be used to support a 4 in. dia. slitting saw, for example, the size of the stock which could be cut (other than in thin wafers) would be reduced from $1\frac{1}{4}$ in. square to only $\frac{3}{8}$ in. square or 1 in. × $\frac{3}{8}$ in. flat section—not much help !

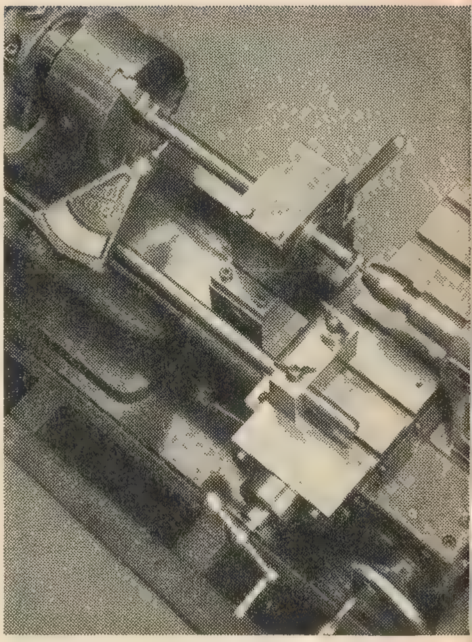
The photograph, Fig. 4, illustrates a typical preliminary set-up. Here, a length of $\frac{3}{4}$ in. dia. bar is being adjusted for concentricity at the chuck end prior to the forming of a centre hole; the three-jaw chuck is fitted without the usual register so that the body, instead of the work, may be allowed to run out of true.

By this means it is possible to chuck work to run concentric within two-tenths of a thou.—or, with a little additional trouble, " spot on "—much more quickly than by using a four-jaw chuck of the independent type. Of course, the tailstock end of the component will always be correctly centred as, once set, the bushing housing needs no further alteration.

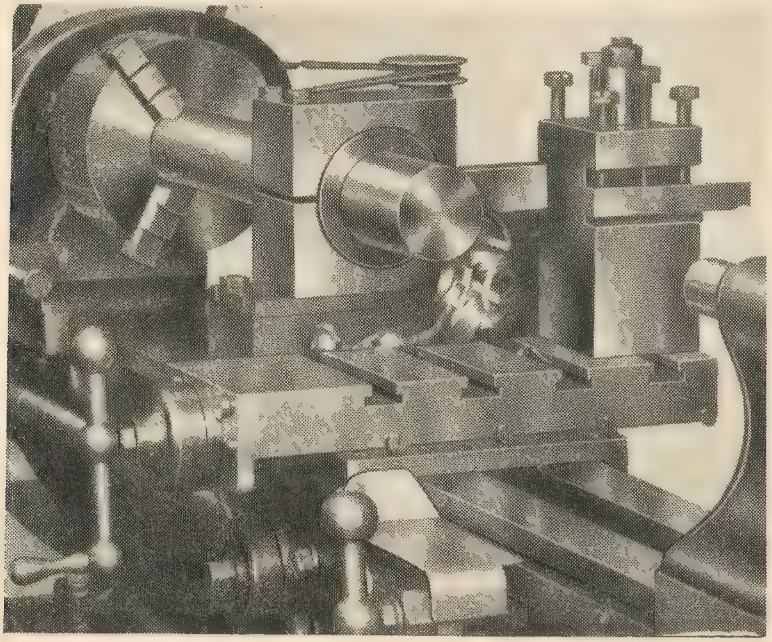
Some of the customary methods advocated for fixed steady work to meet those cases where it is desired to bore a hole in, or similarly treat the end of a lengthy component, are to my mind open to question.

One system recommends that the headstock end be positioned upon the headstock centre and driven by a carrier in a manner similar to that adopted for working between centres. With this method, some means have to be provided to hold the work and carrier in position hard against the " driving " centre; this usually takes the form of lashing the work carrier to the driving plate by means of round leather belting, electric lighting flex, boot laces or string ! Doubtless this practice is satisfactory, but is it the most expeditious ?

If extreme accuracy is the aim then it must be assumed that the work has been previously either machined about that centre or that some precision means have been adopted in the initial centring. Moreover, complications arise if the component is in the nature of a lathe spindle or tailstock barrel both of which generally need a clearing hole right through.



*Above, Fig. 4: " Clocking true " prior to centring the workpiece*



*Below, Fig. 3: The fixed steady in use on Myford ML4. Note the block extension and dial mounting on the lathe cross-slide*

Under these circumstances the end would have to be plugged.

When the work is driven by a chuck, that end does not require a centre hole. If the chuck jaws are in bad condition, or likely to be out of alignment on their gripping surfaces, the distortional effect such faults might have on the driven work may be minimised, if not entirely eliminated, by holding only with the tips of the jaws.

In these cases it is advisable to use a chuck backstop to prevent the work from being pushed in to the chuck under the pressure of a cut or drilling operation. ■

# ? WHITHER POWER BOATING

That is the question L. CASSANET spiritedly raises. Is the enthusiasm really dying . . . are the organisers really lacking in imagination and enterprise ? What say you, the fraternity ?

As THE TITLE suggests I am concerned at the trend of model power boating.

To take hydroplane racing first, the fact is that at an average regatta today the entry is low compared with four or five years ago. I must admit there is a greater proportion of successful runs, and that speeds are higher. But so they should be, or we would have been wasting our time.

The fact that the entry is small suggests that the enthusiasm is dying. Do not let us blame TV—that is an easy way out. I blame the organisers and the entrants for lack of imagination; but more later.

The second and, to my mind, the most significant fact is that with the advent of the high-performance two-stroke, the Glo-plug and the influence of the commercial engine the builders seized upon the two-stroke and have proceeded to " wring it dry."

What have we as a result of this ? A, B and C classes all with the same basic design of engine.

Where has the great army of four-strokers and flash steamers gone ? I will tell you . . . those still left have gone " Glo-plug." Why ?

Now we return to my first assertion that the organisers of competitions are lacking in imagination and enterprise.

The only encouragement the r.t.p. people get is to attain the maximum possible speed over the shortest possible distance, irrespective of class.

What inducement is there to run a four-stroke or a flash steamer ? You are something of a novelty if you turn up with such a craft. Those of you who were at the Grand Regatta this year will know of Mr Bamford's efforts to keep his flash boat going. Mr Bamford's boat was the only one there that had not got a two-stroke installed.

Think back, not so very many years, when we were all eager to see the B and A class boats perform . . . to witness the aerobatics of Mr Jutton's *Vesta*, the fiery roar of Mr Lines' *Blitz*, the breathtaking performance of Mr Clark's four-stroke *Gordon* and the polished run of Mr Clifford's *Blue Streak* to mention but a few. Will we ever see their like again ?

As an organiser, I have in the past attempted to introduce some variety into my programme. I have tried a reliability trial, a 2,000 yd race and a nomination race. Whether or not these efforts were successful I do not know . . . the competitors are the best judges there. But there must be many variations of these and other types of competition which could be arranged.

Now to straight-running events. And what straight events they are ! They have been running in the groove carved out for them by enthusiasts in the late 20s.

Ask any participant in straight-running events what he enjoys most and invariably his reply will be: " The team relay nomination." But where do we find this event on the programme ? If we find it at all, it will be tucked in at the end as a make-weight.

Just think ! You go to a regatta—you may travel five or 50 miles—you enter the nomination and steering events, and your boat may be running for a total time of three minutes. Rather a long way to travel for that, isn't it ? And what sort of view did you have of your boat ? You saw the stern going away from you, then you saw the bow coming toward you. But you did not see it doing a nice turn into wind. What is the solution ?

**Personal views**

I have often been criticised because in our regattas I do not state the length of the nomination course.

My reasons for this are: First, I do not decide on the course until about five minutes before the event. Secondly, how the heck am I to measure it on an odd-shaped pond without surveying instruments. Thirdly, it does not seem to matter anyway; the estimates of time for the course seem pretty accurate.

I would like to run a nomination course on a curve, but so many boats have fixed rudders.

I have not, so far, mentioned radio control. Many of the diehards look down their noses when I do, but whether they like it or not, it has come to stay. At the Grand Regatta I was told that about one-third of the straight runners had radio control fitted.

Those of you who have been to radio-control regattas will not have to be Old Moores to see that radio control events will be more attractive than the r.t.p. and straight runners very soon.

Do not be afraid of radio control. There is nothing mysterious about it, and it has great possibilities.

Readers will no doubt hear in the near future of the recommendations of the M.P.B.A. committee, in respect of radio-control speed events. Briefly they are: 1. Engines up to 15 c.c.—any type of engine may be used single or multi-cylinder. 2. 15-30 c.c.—four or more cylinders only. 3. Method of handicapping—each boat has a minimum weight of $1\frac{1}{2}$ lb. for c.c. of engine capacity.

Now anyone with a twin or single-cylinder engined boat over 15 c.c. capacity is barred from running in these events; the fact that there is a considerable number of boats in this category already does not concern the M.P.B.A. The sole reason given for this ban is on the score of safety. But I wonder if that is the only reason? Could it be that they are afraid that when they see how exciting it can be people will drift away from r.t.p. racing ?

On the question of safety, is it likely a man with a large boat is going to be so careless with the product of his labours that he is going to run to the danger of others, and smash his boat and radio and engine just for the fun of the thing ?

This ban, by the way, does not apply to boats running in other radio-control events.

Now what about some suggestions? Let us see if we can wake up the power-boat fraternity ! ■

# READERS' QUERIES

**Do not forget the query coupon on the last page of this issue**

**This free advice service is open to all readers. Queries must be on subjects within the scope of this journal. The replies published are extracts from fuller replies sent through the post: queries must not be sent with any other communications: valuations of models, or advice on selling, cannot be given: stamped addressed envelope and query coupon with each query. Mark envelope "Query," Model Engineer, 19-20, Noel Street, London, W.1.**

## A metal rectifier

I have an old Trix twin railway transformer for converting 240 V. to about 16 V. a.c. I am anxious to make a metalplate rectifier for converting the output to d.c. with a view to running Hornby Dublo or Tri-ang trains. Has there been an article in MODEL ENGINEER on how to make such a rectifier from parts of some government surplus stock device? If not, how does one go about it? I am banking on a hope that the d.c. trains take less current than the a.c. variety and that losses in the rectifier will not make my plan unworkable. The 16 V. a.c. output of the transformer is when it is off load; it drops to about 12 V. when two Trix engines are working off it together and they are alleged to take 1.5 amps each. The Hornby engines are said to take 0.75-1 amp at 12 V. and the Tri-ang only 0.5 amps at the same voltage.—M.L.B., Slough, Bucks.

▲ *The essential components you require are a transformer of suitable output and a full-wave or "bridge" rectifier. Suitable transformers and rectifiers for this purpose can be obtained on the surplus market. Aero Spares Co, 70-71, High Holborn, London, W.C.1, H. Franks, 58, New Oxford Street, London, W.C.1, or K. McGrath of 244, Marton Road, Middlesbrough, Yorks., are likely sources of supply.*

*It would not be practicable to utilise the existing transformer for operating a d.c. supply system as the losses in the rectifier are fairly considerable—and there may be as high as 60-70 per cent voltage drop in a 12-volt supply system.*

*A series of articles on the construction of a d.c. power pack was published in the companion journal "Model Railway News" from February to May, 1946.*

## Indicator lamp

Can you tell me what method is employed in certain domestic irons by which they are able to use a 2.5 V. flashlamp bulb as an indicator lamp, although the iron is on the mains? I also want to know whether I can use a car bulb (say 6 V.-6 W.) in a similar way as an indicator lamp, on a.c. 230 main.

The point about this is that I am using a 15 W. lamp as an indicator, and the heat generated in a confined space is objectional, and apparently a lower wattage bulb for the mains is not made.—R.A., Hammersmith, W.6.

▲ *In the case of a low voltage lamp bulb as an indicator lamp on apparatus working on mains voltages, this is usually done by connecting the lamp in series with the main circuit or possibly a portion of it, so that the resistance of the latter acts as a potential divider.*

*As to a domestic iron consuming approximately 450 watts at 220 volts, the current consumption would be approximately 2 amperes. If a low voltage lamp taking 2 amperes is connected in series with this circuit, it will work satisfactorily. If, however, a lamp of lower current consumption is employed it would be burnt out.*

*This is simply an illustration of the principle normally employed, but if it becomes necessary to use a lamp with a different current consumption from that of the main circuit, the conditions become much more complicated.*

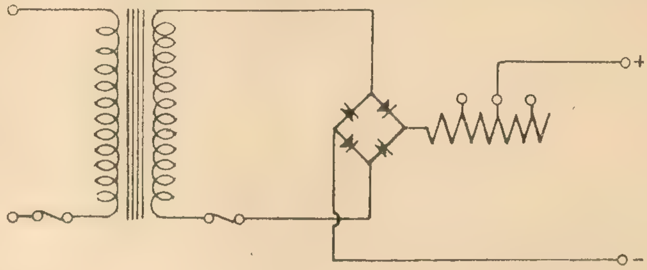



*Diagram of a transformer and rectifier system (see "A metal rectifier")*

## Motor winding

I should be grateful if you will solve a problem concerning an ordinary domestic 12 in. oscillating fan which has just come into my possession. The rating stamped on the maker's plate is: Volts 175-195, Watts 60-70, Cycles 50.

The motor is a shaded pole type with squirrel-cage rotor, and although there are four pole faces in the stator, there are only two coils, diametrically opposite, the remaining two poles being left bare. The motor was supposed to be burnt out but the only information I could obtain was that "it got hot"—due presumably to it being run on 230 V. mains. However, one coil was practically burnt out, and the other rather discoloured but still usable.

I therefore set to to wind a new coil, using 30 S.W.G. enamel wire (same as original). I had no idea how many turns to put on, so I made a former of cardboard of such a size as would just go between the adjacent pole pieces, with allowance for tape insulation. This I filled with the 30 S.W.G. enamel wire and though not as neat as the original I was gratified to find that the d.c. resistance was approximately 20 ohms—almost the same as the original coil I was intending to use again. After insulating, I refitted both coils to the stator, and connected them in series, one to produce a north pole and the other a south pole in the rotor tunnel. Then on reassembly I switched on, applying 160 V. from an autotransformer, but within a few seconds a wisp of smoke appeared from the coils so I switched off.

Connecting an a.c. ammeter in series I tried again, but with the same result, though I managed to get the reading which was 1.5 amps. The whole motor was now definitely hot. However, I reduced the voltage with the autotransformer to 100 and the current was 1 amp. I managed finally to reduce the current to 0.3 amp by means of a lamp in series with the output of the autotransformer. But the voltage across the motor leads was only 50 and it would not revolve. I gave up!—R.H., Ripon, Yorks.

▲ *The fact that your motor has four poles and is only wound on two does not affect its performance in any way; it is easier to wind and assemble two coils than four. Where a motor is so wound the inter-coil connections should be arranged so as to produce consequence poles, and not alternate north and south. The two vacant poles will pole up correctly. The wire size you are using is too large and the turn value is in error. Wound as now, two coils each having 1,200 turns of 34 plain enamel covered wire may be used. If you prefer to wind it as a true four-pole machine then there will be four coils, each having 600-700 turns of the same gauge wire (work to the higher figure if possible).*

*The coils when wound should be insulated with one layer of Empire tape to 5 mil. thickness and one layer of cotton tape of the same thickness. After assembly the coils should be varnished and baked out with any flexible armature varnish. Shellac varnish should not be used. If the motor is to be arranged for four poles, the poles should come up as north and south respectively round the stator. The rotor revolved toward the shade rings and the motor cannot be reversed by simply changing the supply connections. This should be noted when reassembling the motor. If this motor has been run and allowed to get really hot, the shade rings should be looked to because if they are soldered it is possible they may be disturbed, and if imperfect contact exists here the motor will not run satisfactorily.*

### Suitable oils

I am fitting my Zyto 3⅜ in. lathe with a coolant system and would like to know whether to use a water soluble oil or a cutting oil, where I could buy small quantities of the oil recommended and where to obtain a small length of ⅜ in. bore plastic tubing for the above.—S.M., Weymouth, Dorset.

▲ *A great deal will depend on the particular operations being dealt with and the metals to be machined. Soluble oil is a very suitable all-round lubricant, particularly for work on steel within the capacity of a light lathe. Lard oil or straight cutting oils of any kind are useful for heavy cutting operations, including screwcutting with taps and dies. But as a coolant they are inferior to soluble oil. Buck and Ryan of 310-312, Euston Road, London, N.W.1, can supply small quantities of either soluble or straight-cutting oils.*

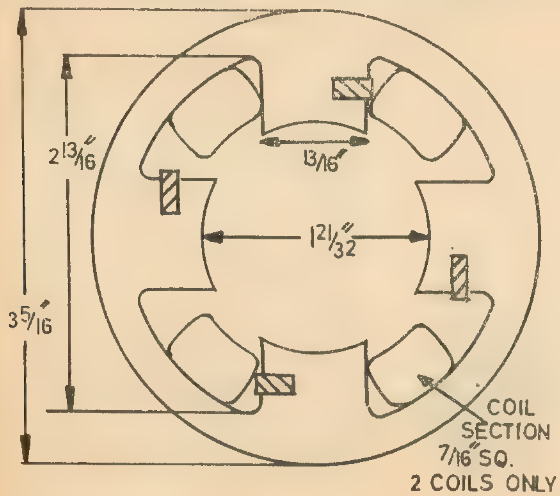
*For a small length of ⅜ in. bore plastic tubing contact G. H. Bloore Ltd, 66, The Broadway, Mill Hill, London, N.W.7.*

### Removing sharp edges

I have cross-drilled some 1 in. round bar with a 41/64 in. drill to clear ⅝ in. Through these holes slides a round bar. The edges are square and as a result score the bar as it slides. If it were flat material it would be easy to radius the sharp edges, but through the round material it constitutes a problem. How do you suggest I tackle it ?—E.C., Liverpool.

▲ *It would be possible to do this by using a hand scraper, afterwards polishing the edges with a strip of abrasive cloth.*

*However, this seems to be a rather badly-designed arrangement for sliding bars, as the bearing would be very limited in length and any tendency to tilt would cause scoring. If it is possible to do so it would be much better to use a square 1 in. bar turned down for the majority of its length except where the holes occur, as this would give a much better bearing surface and also simplify forming a radius on the edges.*




*A suggested method of rewinding a fan motor. See "motor winding"*

# BROWSING AMONG THE P.M. BOOKS

With the increasing popularity of 16.5 and 18 mm. gauges, railway modellers are giving much more attention to scenery. For many enthusiasts the small model train of today travels through a defined countryside.

To meet the further growth of interest which can be expected this year, John H. Ahern's *Miniature Building Construction* (Percival Marshall, 10s. 6d.), which is recognised as the classic general survey of scenic modelling, has been issued in a revised edition. Stylish format, clear type and many illustrations in photograph and line make the book a pleasure to examine, and the reader's expectations are completely fulfilled by the text. Mr Ahern writes with grace and geniality and with a pleasing absence of narrowness which allows him, for instance, to mention James Joyce on his first page.

From a beginning distinguished by clarity and common sense, the reader is taken deeper into his subject with a discussion of tools and materials, and then of a variety of buildings—cottages, farms, shops, factories, inns, garages and railway structures—as well as of such important adjuncts as walls and fences. Low-relief modelling and background scenery are described in detail, and ship modellers will welcome the chapter on lighthouses and harbour lights.

While the book therefore has a width of approach that ensures it a place in every up-to-date modelling library and also in many schools, it is written by a modeller—the creator, as readers of *Model Railway News* are aware, of the ever-interesting Madder Valley Line. Happily combining these two qualities, breadth of treatment and a careful particularity in the description of each process, Mr Ahern is the best of guides to the practitioners of a fascinating craft.—J.M.

# Expert's Workshop

**DUPLEX concludes his description of**

# A LATHE SAW TABLE

THE SAW ARBOR illustrated in Fig. 6 is designed for mounting between the lathe centres and it will be noticed that the coned female centres are shown drilled in a recess in order to protect the contact surfaces from accidental damage that might give rise to eccentric running.

When making arbors of this kind a length of mild-steel bar should be machined all over and screwcut to the finished size, except that the abutment and register surfaces for locating the saw should be left a few thou. oversize and afterwards turned to the finished dimensions as a final machining operation to eliminate any distortion caused by internal stresses in the material being liberated.

The register portion on which the saw is carried must be turned to an accurate fit in the bore to ensure concentric running; this will be facilitated by making this portion of the arbor long enough to allow for trial cuts at the extreme end.

As an alternative measure an accurate fit can be readily obtained by inserting a standard taper mandrel in the bore in the saw and then marking the point of engagement with a grease pencil. The diameter of the mandrel at this point is measured with the micrometer and the saw arbor is in turn machined to the same diameter.

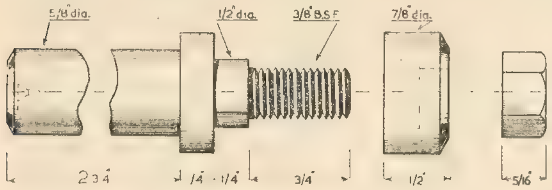
The loose collar for clamping the saw in place must be recessed deeply enough to allow it to close on the abutment face of the arbor and secure even the thinnest saw.

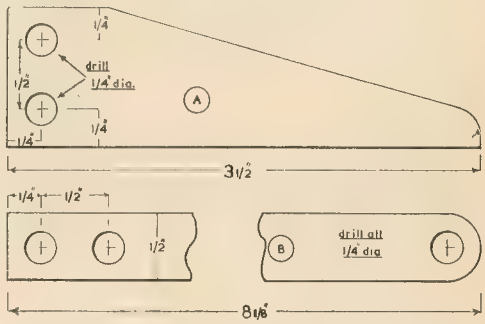
It is important to machine the two faces of the collar truly parallel, otherwise the arbor is liable to become bent when the clamping nut is fully tightened.

Although it is not shown in the drawing, a flat should be formed at the tail of the arbor to give a secure hold in the vice while the clamping nut is tightened and also to provide a bolting surface for the lathe carrier used for driving the arbor in the lathe.

Where a commercial nut is used as a clamping nut it is again important to ensure that the abutment face is truly square with the threaded bore; if necessary the nut is mounted on a threaded arbor and a facing cut is taken over the contact surface.

Where the saw table is accurately made and set square to the lathe axis the guide fence illustrated in Fig. 7 enables work to be sawn with its sides exactly parallel and with its edges cut truly square.

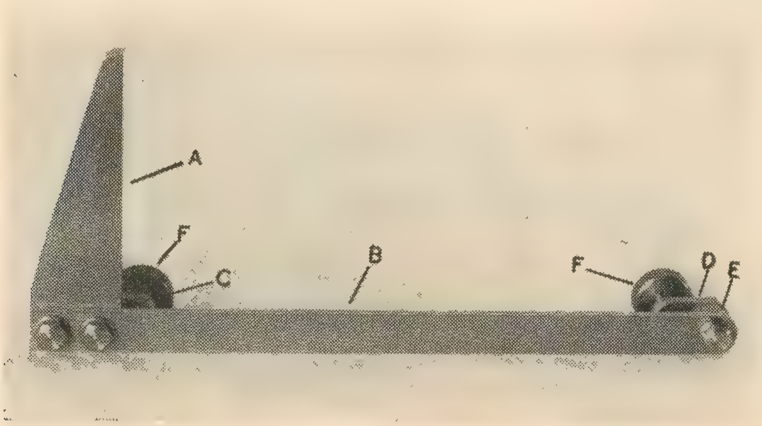



*Above, Fig. 6: The saw arbor*

*Right, Fig. 8: Stock and blade of guide fence*

*Below, Fig. 7: The guide fence. (A) the stock; (B) the blade; (C and D) clamp bars; (E) distance piece; and (F) two clamp screws*




The fence consists of a stock, *A*, a blade or guide, *B*, and a clamping device at either end for securing the attachment to the saw table. The stock abuts the near edge of the table and locates the blade parallel with the left-hand table edge. As the blade forms the datum surface against which the work slides, it should be accurately made with its contact edge straight and square. To finish the blade it is drilled on the centre line for the three assembly bolts.

After the stock has been cut to shape and the abutment face accurately finished it is fixed in position on the blade by means of two toolmaker's clamps for drilling the holes to receive the two attachment bolts.

The two parts are checked before

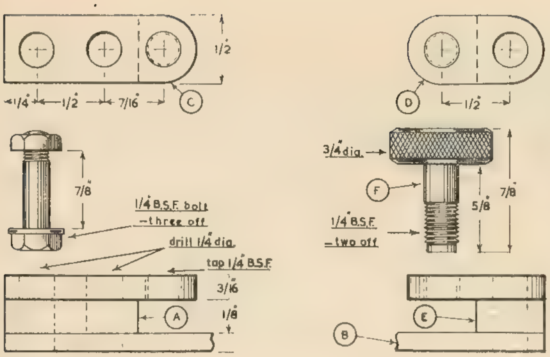



*Fig.* 9: *The guide fence components*

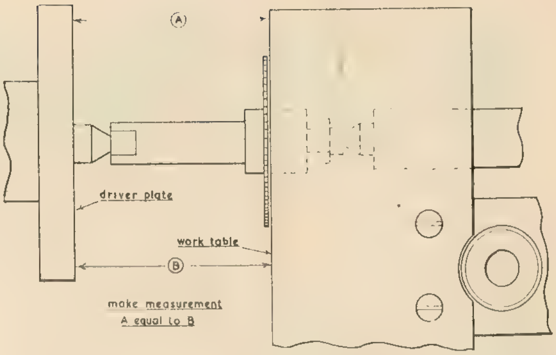



*Fig.* 10: *Showing the circular saw and the sawing table set up in the lathe*

drilling and again after assembly with a try-square so that any slight error of alignment can be corrected by filing one of the bolt holes. Nevertheless, it is more workmanlike to use close-fitting bolts in reamed holes rather than be dependent on the correction of faults during assembly.

Although $\frac{1}{4}$ in. B.S.F. bolts with small heads and nuts are illustrated, standard 2 B.A. bolts will be found amply strong for the present purpose and they will also give the finished work a neater appearance.

The clamping bar, *C*, is best drilled for the two attachment bolts by clamping it to the stock and making use of this part as a drilling guide.

On the other hand, drill holes can be very accurately located and transferred from one part to another by working methodically when marking-out. For example holes may be spaced at equal distances apart by setting the dividers against a rule and then scribing the hole centres on several parts without altering the original setting.

For this purpose the points of the dividers should be kept really sharp and a fine-pointed centre punch can be located exactly at the junction of the cross-centre lines with the aid of a magnifying glass.

If the centre punch is stoned to a sharp point it can often be guided into the correct position by the sense of touch alone even where the dimension lines are only lightly scribed; in this connection any attempt to scribe the lines deeply should be avoided as it may lead to inaccurate marking-out.

The distance piece, *E*, which is of the same thickness as the stock itself, can either be parted off to length from a piece of axially-drilled $\frac{1}{8}$ in. dia. rod or flat bar material can be used for the purpose.

The knurled clamping screws, *F*, may be of built-up construction in order to save material, but time will be saved if these components are turned from $\frac{3}{4}$ in. dia. mild-steel rod. Parts of this kind are best made from free-cutting or lead-alloy steel which besides having ample strength and wearing qualities is readily machined to a high finish when carrying out ordinary turning and screwcutting; moreover, knurling is greatly facilitated and the work can usually be brought to a good finish by a single passage of the knurling wheels.

**Table adjustment**

As the left-hand edge of the table is made exactly square with the front edge it forms a datum surface for aligning both the table and the guide fence. This surface can readily be set square to the lathe axis in the way illustrated in Fig. 10 where the toolholder is rotated on the toolpost until equal measurements between the surface of the driverplate and the edge of the table are obtained at two widely separated points.

Although saw tables are usually made with a slot in which the saw rotates, the form of table illustrated has been found quite satisfactory in practice; but the edge of the table should be brought as close as possible to the face of the saw without the teeth rubbing.

The height of the table should be adjusted to bring its under surface just clear of the collar clamping the saw to the arbor so as to allow the saw to cut to the maximum depth. With the table in this position the toolpost will project for a short distance above the surface of the table and this will limit the width of the material that can be sawn. This difficulty is overcome by raising the table until it is flush with the top of the toolpost, but it may then be found advisable to fit a larger saw to deal with thicker material.

After the material has been cut into parallel strips the ends can be sawn squarely across by securing the work to the table with one or more toolmaker's clamps and then moving it forward against the saw by means of the cross-slide feed.

In the case of the Myford ML7 and other lathes of this kind it would be possible to attach the saw table to the four-tool turret and use packing strips to adjust the table to the most suitable working height. ■

## CHANNEL CROSSING BY RADIO CONTROL

READING the recent Smoke Ring [December 27] on diesel reliability reminded me of the occasion in 1951 when I sailed a 5 ft model boat from Dover to Calais under radio control.

The engine was a standard E.D. Mark IV 3.46 c.c. diesel, fitted with water cooling for marine work. The propeller was two-bladed, $3\frac{1}{4}$ in. dia. $\times$ $1\frac{1}{2}$ in. pitch.

On the crossing the revs were kept down to about 5,000 per min. giving a speed of $4\frac{1}{2}$ knots. The boat had a beam of 2 ft and a weight of nearly 70 lb., so the engine was pulling hard all the time.

Owing to a faulty compass the crossing took nine hours and in all that time the engine stopped only once, due to a patch of seaweed jamming the propeller. This happened when we were about three hours out from Dover. No adjustment was necessary when we restarted the engine.

The sea was moderately rough in mid-Channel and the model got a lot of buffeting, which did not make things easier for the engine.

During the crossing the engine made nearly $2\frac{3}{4}$ million revolutions, nearly 2 million of which were continuous. We set out to prove the reliability of radio control and while that was 100 per cent. the tiny engine showed up equally well.—E.B. ■

# POSTBAG

The Editor welcomes letters for these columns, but they must be brief. Photographs are invited which illustrate points of interest raised by the writer

## UP THE SPOUT

SIR,—Your query [Smoke Rings, December 27] has a very simple answer—your colleague was incorrect in maintaining that waterspouts are raised.

Waterspouts occur when the air is both warm and humid and are formed when vortices are produced under those conditions. There is such a reduction of air pressure within the vortices that precipitation of rain or mist occurs. The familiar gyrating rope of raincloud is then produced. They grow downward from the cloud base and the sea below soon becomes disturbed. At the point of contact with the sea, water does in fact rise—but only by a matter of feet, because of the negative pressure existing in the vortex above it.

Whereas the rate of progress bodily of a waterspout may be anything up to 40 m.p.h. the wind speed within the vortex may be hundreds of m.p.h.

This note does not, of course, claim to do more than indicate the simplified explanation you sought.

Neath. A.R.J.

SIR,—What causes waterspouts? No doubt vacuum is the first cause but the height, sometimes of tremendous proportions, is caused by the terrific velocity of the air which sometimes exceeds 500 m.p.h.

When it is realised that this force is whirling in a diameter of a few hundred feet, it can be understood how a column of water far beyond the normal 34 ft in height can be supported.

Maidstone, Kent. CHARLES E. HOOKER.

## 1901 VINTAGE

SIR,—The C.R. locomotive mentioned by H. A. Robinson [Postbag, January 10] is almost certainly the 2 in. scale *Dunalastair No* 2 built by Mr P. Douglass Croall, of Craig Court Castle, Midlothian, and exhibited at the Glasgow Exhibition of 1901.

A report on the exhibition by the late Percival Marshall appeared in MODEL ENGINEER of 1 October 1901 and included a short description of the model, together with two very fine photographs. It appears to be a magnificent piece of work and is painted and lined in true C.R. style

The leading dimensions are: cylinders $2\frac{5}{8}$ in. × 4 in., driving wheels $12\frac{1}{2}$ in. dia., bogie wheels 7 in. dia., copper boiler $9\frac{3}{4}$ in. dia. with 24 $\frac{7}{8}$ in. dia. tubes, pressure 120 p.s.i., firebox $11\frac{1}{2}$ in. long, total heating surface 2,025 sq. in., height to top of chimney 26 in., overall length 9 ft 11 in. The tender carries 18 gal. and $\frac{1}{2}$ cwt of coal. There are two "Vic" automatic injectors, two water-gauges, steam-sanding gear and steam brake.

I have no information on its history from 1901 until its appearance in Wales, but I hope that such a fine example of model engineering will not be allowed to become derelict.

Chiswick, W.4. N. D. WILLOUGHBY.

## DOING THEM UP

SIR,—I am engaged in renovating one or two traction engines, a fact which drew a report and picture in the local paper.

The engine they illustrated is a Ransome 7 h.p. general-purpose type; I have also a Burrell 7 h.p. single-crank compound. Both have had extensive repairs carried out and have been repainted bringing them up to a fine state of preservation.

I have just started on a 7 h.p. general-purpose Clayton and Shuttleworth which is about the last one they made.

Baldock, Herts. ALBERT E. DEANS.

## STEAM CARS

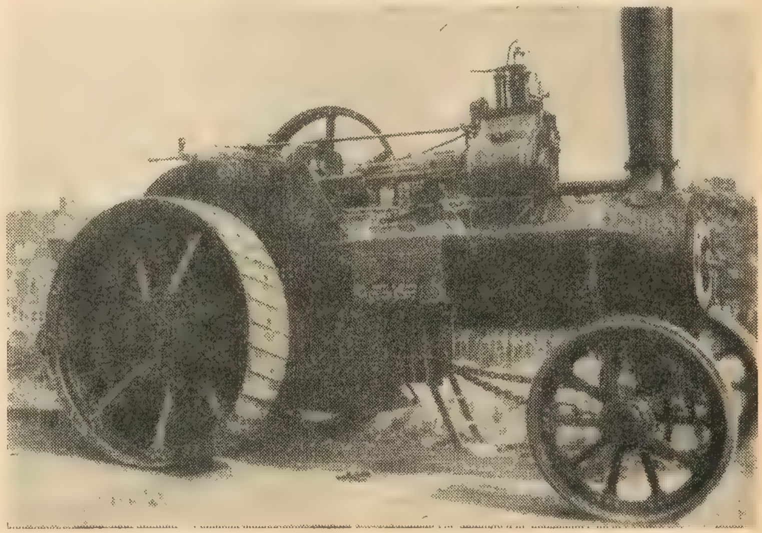
SIR,—May I say how delighted I was with the two recent articles on steam cars by George W. McArd, and I sincerely hope that they may form an introduction to more detailed articles from the pen of this expert.

I feel that some information from Mr McArd on the pros and cons of compound, simple, double-acting and single-acting engines would be welcome by those, like myself, to whom this subject is fascinating.

I agree with Vulcan and K. N. Harris that building a steam car is a big job, not to be undertaken lightly, but many of us are interested in building a steam power unit for an existing car. And, after all, if one wishes to indulge in this as a hobby, a secondhand car can be purchased very cheaply.

A friend has just been offered a

*A Burrell 7 h.p. single-crank compound general-purpose traction engine which was renovated by Albert E. Deans*



small car chassis, less engine, which would take a steam plant very nicely, for the princely sum of £8.
Saltford, Somerset. ANDREW SMITH.

## THE STEAM AGE

SIR,—I enclose a photograph of a Marshall traction engine which we keep at one of our stone-crushing plants, and which we use on heavy hauling jobs.

This engine is 43 years old and still in perfect condition, apart from wastage at some of the tube ends. It still bears a certificate for 150 lb. pressure, and I may say it astounds some of the younger i.c. fans when we take a hold with the winch rope.

The picture illustrates the engine drag-lining chippings from a stockpile; and it is used for such diverse operations as pulling trees out, moving heavy machinery, and hauling skips from the quarry, when at times the electric winches have been out of order.

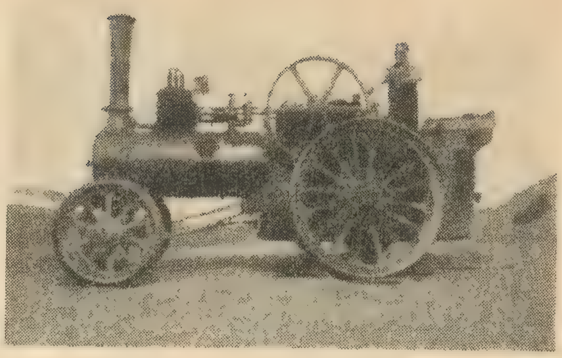
We endeavour to keep it clean and tidy, but the dusty conditions in which it is stationed render this difficult and we cannot do credit to such a useful and reliable "Old Faithful."

I may be old fashioned but it depresses me to see steamships with an i.c. engine or electric motor; even as recently as this summer I scoured around the parks and did not see one steamer.

There appears to be one branch of industry that is never represented in the model world and that is coal mining. I wonder why this is, as I feel there are no finer steam-engines than a colliery winder, or a main and tail hauler. These engines are always magnificent examples of the horizontal class.

I intend to make a model colliery winder and I would be glad to have correspondence with others interested in such machines.

I appreciate that from the economist's point of view reciprocating steam-engines are obsolete, but I prefer to view them in the light that illumines the human desire to preserve all things of grace and beauty; if they cannot be allowed to work for us, at least we cannot be deprived of the pleasure of making models of them and preserving for posterity the fascination of the "Steam Age."
Northumberland. G. W. WALKER.


*The Marshall engine referred to in the letter from Mr Walker, Northumberland*

## STEAM GUN

SIR,—The article on jet propulsion in the 18th century [MODEL ENGINEER, January 3] reminded me of a small toy fieldgun which was brought out during the South African War (*c.* 1901).

The barrel was a small copper tube about the size of a detonator closed at one end. A small quantity of water was poured down the muzzle and a small cork rammed in the open end. The barrel was slightly elevated to retain the water at the closed end which was heated by a small stump of candle.

In a very short time the water boiled and the cork was expelled with considerable force. Needless to say this toy (which was priced at 3d. !) did not meet with the approval of the grown ups.

On the subject of toys of that period it is interesting to recall some of the prices. A small vertical oscillating steam engine could be purchased for 6½d., a better one for 1s. and one with a lead-alloy cylinder, slide-valve operated by an eccentric, and the boiler with a central flue for 1s. 6d.

An "O" gauge locomotive with an oscillating cylinder in the cab geared to the rear axle cost 4s. 6d. Its realistic appearance was rather spoilt by an external heavy lead-alloy flywheel on the offside of the cab, but it was a good little engine and pulled quite a heavy load for its size, the boiler being heated by a methylated spirit lamp having two burners, the container fitting under the cab.

When one considers it was also fitted with a safety-valve and whistle it was amazing value.

Another toy we had was a steam tug which cost 6s. 6d. This we only dared sail on the local pond in very calm weather owing to its low waterline. Needless to say all these toys were of German manufacture.
Carlisle. J. F. PERRIN.

## SOLDER AND CERAMICS

SIR,—With reference to the query "Soldering Problem" [December 27] it is customary to use a cadmium solder when soldering to the electrodeposited silver band on ceramic articles. The melting temperature is below that of 60/40 solder and the disintegration of the silver band is considerably reduced. It should be noted that the temperature must be very closely controlled or the solder is spoiled.
Braintree, Essex. D. THOMSON.

## SLEEVE VALVES

SIR,—I have been extremely interested in the recent correspondence regarding the Knight engines as fitted to the Daimler car, and it occurs to me that some of our younger members may not know the history of this famous unit.

About 1901, a young man, Charles Y. Knight, was employed at his father's sawmill in Illinois, tending and repairing the steam engine that powered the mill. His father had recently purchased a horseless carriage, a Fournier Searchmont, which was extremely noisy and Charles Knight thought that the steam engine's slide-valve principle applied to the automobile engine would make a quieter vehicle.

With the aid of a friend, L. B. Kilbourne, Knight succeeded after several years in making the slide-valve automobile engine a reality and he called it the Silent Knight.

A car was built and entered in the 1906 Glidden Tour but unfortunately it did not complete the course and was eliminated. Undismayed, Knight took his engine to England where Daimler accepted it and produced it in quantity. Incidentally, it was also made in Belgium, France, Germany and Italy, and in America by Stearns, Root and Vandervoort Brewster, Atlas and Sterling.

In 1913 John N. Willys bought up all the American rights and used the engine in his Willys Knight Car until 1932 when the master patent expired. However, the modern high-speed poppet-valve engine gradually replaced the slide valve and today they are entirely out of production.
Edinburgh. JAMES. H. FARR.

# CLUB NEWS

**WHEN the Liverpool Overhead Railway opened to the public in 1893 one of its first passengers was George Williams, a boy of 11. Before the line closed for ever on the last Sunday evening of 1956 Mr Williams, now 74, travelled on it again, for the last time.**

There were may who made this sentimental journey. Although the greater part of the staff were accommodated in other work, all of them were sorry to see the old Overhead close. It says much for the private management that it could earn the loyalty of a veteran like Signalman George Bowers who began on the Overhead as a porter in 1913 and remained for 43 years, if we include his service in the First World War.

Even with modern machines it will take quite a time to remove the Dockers' Umbrella. Meanwhile the Liverpudlians are thinking of happier events in the programme for 1957.

This year is the 750th anniversary of Liverpool's first charter. Such an occasion asks to be celebrated by all the organised bodies in this great port. But the 750th year of the charter also happens to be the hundredth year of a key institution, the Mersey Docks and Harbour Board.

Among the organisations which have a direct reason to celebrate the centenary is the **Liverpool Nautical Research Society,** and so the society's open meeting in February is being devoted to "Liverpool's Dockland One Hundred Years Ago." H. A. Taylor of the Liverpool Record Office, who is also a member of the L.N.R.S., is to speak on the relevant pictorial and written records in the possession of the Liverpool libraries.

"This will not be a highly technical or detailed study," writes chairman R. B. Summerfield, "but an attempt to recall something of the atmosphere and customs, just as they were felt and recorded by artists and journalists, or typified by advertisements and other commercial records."

Naturally, the members are also keenly aware of the larger celebration this year. Liverpool owes its history to the sea, and what could be closer to that history than a society immersed in nautical research?

**ANY MORE FOR TEA?**

At four o'clock on the afternoon of February 16 members of **Sussex Miniature Locomotive Society** foregather in the Tea Room at Beech Hurst for the society's annual meeting. They will also enjoy the more normal amenities of a tea room. Because of this, secretary S. R. Bostel is anxious not only to have a large attendance but to know who is coming so that the right number of high teas will be ready.

In future the second Sunday in each month will, as far as possible, be visiting day. The choice of a definite date makes it unnecessary for the members to be notified whenever visitors are coming, but the arrangement is by no means like one of the laws of the Medes and Persians.

If a club finds the date unsuitable the Sussex M.L.S. will try to cooperate accordingly. One visit is already in the diary: Maidstone Society on the second Sunday in May. There are also hopes of a visit from Birmingham at a later period.

Although June seems a long way off many traction engine enthusiasts will be glad to mark off a couple of June dates in their diaries before they forget.

The occasion is the Rempstone Steam Traction Engine Rally of 1957. Mr J. Byers is holding it at the Steam Plough Works, Rempstone, on June 29 and 30.

As in 1956, the local vicar will lead a service at the field on the Sunday afternoon (June 30) and the proceeds from the two days will be devoted to the Blind.

This announcement comes to me from N. Ayres, a member of the committee, whose address is 1, Cameron Avenue, Leicester.

## M.E. DIARY

**January 31.**—Hull S.M.E. "Transport Development," G. S. Shepherdson.

**February 1.**—J.I.E. Pepys House, "Trans-ocean Deep Sea Submerged Repeater Systems," E. F. S. Clarke, 7 p.m.

**February 2.**—S.M.E.E. rummage sale, 28 Wanless Road, London, S.E.24, 2.30 p.m.

**February 6.**—J.I.E. Midland Section, film evening and meeting with Institution of Water Engineers, Birmingham 7 p.m.

**February 7.**—Eltham and District L.S. "Boiler Brazing," chairman A. L. Hutton.

**February 8.**—J.I.E. Pepys House, "Kinematic Design," R. J. Herbert, 7 p.m. Institution of Mechanical Engineers, "Economics of Plant Replacement and Renewals," C. W. Griffiths, headquarters 6 p.m. Welling and District M. and E.E.S. "Bits and Pieces," 8 p.m.

**February 11.**—J.I.E. Sheffield, "Power Station Construction." S. S. Ellam, 7.30 p.m. Clyde S. and M.M.S. Nautical quiz, Hugh Launder and William Forth (illustrated) Kelvingrove Museum, 7.30 p.m.

**February 12.**—Bristol Ship Model Club, "Mediaeval Ships," N. H. Poole, Legion House, Portland Square, 7 p.m. Institution of Mechanical Engineers, Automobile Division general meeting, papers, headquarters 6 p.m.

**February 13.**—Birmingham S.M.E. film show, King's Arms.

**February 14.**—Liverpool N.R.S. open soirée. Hull S.M.E. visit to Hull Model Railway Club. South London Ship Model Society club night.

## VIRGINIA . . .

continued from page 172

If a few scraps of asbestos millboard are kneaded up to a kind of putty with a little water and a fillet of this put around each pipe, pressing it well into the annular space between pipe and smokebox, it will set hard after the first steam-up and form a perfect seal.

If a tender or a flat car is available the engine can now be tried on the road. Although I have made many locomotives during my long life I still get the same thrill when trying out a new engine as I did when a child of 10 when my first "all-my-own-work" locomotive, with a coffee-can boiler and four lids for wheels, got out of control, dashed off up the passage, tried to climb up on to the doormat, overturned, and set fire to the mat.

I thought mum was going to be, well, annoyed—shall we say?—but she wasn't; she was pleased that my effort had been successful. Space has run out, so I'll have to defer some hints on making a test run until the next instalment.

● *To be continued.*

Classified Advertisements together with remittance should be sent to Model Engineer, 19-20, Noel Street, London, W.1, by latest Thursday morning prior to date of publication. Advertisements will be accepted from recognised sources by telephone. GERRARD 8811. Ex. 4

# Model Engineer CLASSIFIED ADVERTISEMENTS

★ Private: 3d. per word. Trade: 6d. per word. Minimum 12 words. Use of box 1s. 0d. extra.
★ Rates for displayed advertising in this section. Trade 35s., Staff 45s. per single column inch. (Column width $1\frac{5}{8}$ in.)



## WORKSHOP EQUIPMENT

**Buck & Ryan for Lathes and Workshop Accessories,** drilling machines, grinders, electric tools, surface plates, etc.—310-312, Euston Road, London, N.W.1. Phone: Euston 4661.

**Users of the "Atlas,"** "Sphere," "Halifax," "Acorntools," and "Little John," 5″ s.s. and s.c. lathes will be pleased to know that all spare parts and a comprehensive range of additional equipment are available ex-stock—send for price lists. Spare parts also available for the "Atlas" and "Buffalo" (U.S.A.) drilling machines. —THE ACORN MACHINE TOOL CO. (1936) LTD., 610-614, Chiswick High Road, London, W.4. 'Phone: Chiswick 3416 (5 lines).

**Immediate Delivery from Stock,** Myford "ML7" and "Super 7" lathes, Super Adept lathes, bench planers, shapers, electric motors, small tools.—F. W. KUBACH, 12, Sylvan Road, London, S.E.19. LIV 3311/12.

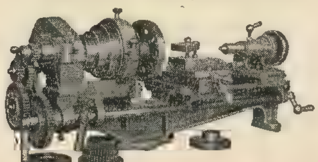
**Lathe Attachment** and castings, drill grinding jigs. List 6d.—G. P. POTTS, Yew Grove, Troutbeck, Windermere.

**Wood Lathes,** motors, jig saws, planers, circular saw blades, saw spindles and benches, turning tools, etc. New illustrated literature, price list, extended, credit terms now available, price 6d. (stamps please).—D. ARUNDEL & Co., Mills Drive, Farndon Road, Newark, Notts.

**Complete Workshop.** Lathe, milling machine, grinder, bench drill, motor, belt driving complete in iron frame. Many accessories, and material. Bargain.—WHITE-HART, Colyton, Devon. Phone 439.

**High Speed Steel Reamers,** 7/32″, new, 3s. 6d., three for 9s. Centre drills, $\frac{1}{8}$″ and 3/32″ H.S.S., 1s. 3d. each, 12s. doz. Pressure gauges, 0.500 lb., 10s., 0-200 lb., 6s.—K. HYDE, 572, London Road, Northwich.

**CHARLES PORTASS & SON**
**Buttermere Works, Sheffield 8**



Est. 1889
**Model S. Lathe**

**Wanted.** 6″ or bigger double ended grinder.—BARNARD, Linden Cottage, Nuns Walk, Virginia Water, Wentworth 2005.

**Wanted. Lathe 5″ or 6″** s.c. Price particulars to—27, Rillbank Road, Leeds, 3.

**ML7 Lathe** on stand, large amount of accessories, new Adept shaper. Electrix spray, many tools, drills, taps, dies, reamers, locomotive castings, screws, bronze, etc. Above, new or as new, £125. Contax IIA flash, enlarger, etc., £75.—CULLEN, Noodle Farm, Scapegoat Hill, Golcar, Huddersfield.

**Wanted.** $\frac{3}{8}$″ or $\frac{1}{2}$″ bench drill, mo torised state condition, price.—WILMOT, 61, Willoughby Road, Bourne.

**For Sale. South Bend $4\frac{1}{2}$″ Lathe.** 4-jaw, faceplate, etc. Offers.—WALKER, 48, Anchorage Road, Sutton Coldfield.

**Send for List** of new tools at bargain prices: drills, taps, dies, reamers, hacksaw blades, endmills, S.F. cutters. Send s.a.e. to —A. KING, 152, Halfway Street, Sidcup, Kent.

**Black and Decker** sander, polisher, drill U50B, list price, £9 10s., new, guaranteed, £7 19s. 6d.—54, Robson Avenue, Willesden, London, N.W.10. Willesden 1172.

**Myford ML7** on makers stand with motor, standard equipment, s.c. chuck and set boat tools. Excellent condition, £60 o.n.o. north Wales area.—Box No. 8395, MODEL ENGINEER Offices.

**Grayson $3\frac{1}{2}$″ B.G.S.C. Lathe,** 1/3 h.p. motor, c/shaft, steel stand, etc., £32.—71, Longford Street, Warrington.

**Myford ML4,** two chucks, vertical slide, etc. Recently fitted new bed and tailstock by Myford. Extensive stock bar material, 1/3 h.p. motor, bench, nearest, £40.—11, North Drive, Ruislip 4238.

**York Lathe 10″** bed, $\frac{1}{4}$ h.p. motor, two chucks and countershaft, £20.—Box No. 8400, MODEL ENGINEER Offices.

**$3\frac{1}{2}$″ Lathe S.C.B.G.,** excellent condition, stand, treadle, chucks, etc., £14. New 4-jaw chuck, £4. Forward reverse switch, £1.—GUY, 7, Brockhampton Road, Havant, Hants.

**Home-made Lathe** 5″ centre height × 16″, ball-race headstock, £5. Two $4\frac{1}{2}$″ 3-jaw s.c. chucks, £2 each. Will sell in one lot for £8.—J. SAUNDERS, 40, The Quadrant, Totley, Sheffield.

**Micrometers,** brand new M./Wright, No. 961B, 0-1″, 79s. 6d. Brand new Shardlow 0-1″, 47s. 6d., 1-2″, 62s. 6d. Brand new 6″ 4-jaw, independent, lathe chucks, 80s.—Below.

**Atlas 3″ × 12″ B.G.S.C.** bench lathe. With standard equipment, plus 4″ s.c. and 4″ independent chucks, 4-way tool post, drill chuck, countershaft, almost new B.T.H. $\frac{1}{4}$ h.p., 230/1/50 motor and reverse switch, £29 10s.—W. MOLDON, 364, King Stieet, London, W.6.

**BARGAIN SPOT**
**Sparking Plugs** 10 mm. by a.c. 1/- each (post 6d.). 10/- doz. (post 1/6).
**Easyflo Paint** solder and flux mixed, 1 oz. jar 9/- (post 8d.).
**Ball Races** $\frac{3}{16}$″ bore x $\frac{1}{2}$″ o.d. x $\frac{5}{32}$″. 2/- each (post 4d.). 21/- doz. (post free).
*List Free*
**K. R. WHISTON**
**(Dept. M.E.N.), NEW MILLS, STOCKPORT**

**Post Orders Only.** New bargains, post and packing, 1s. extra under £1 orders. Breast drills, $\frac{1}{2}$″ chuck, 27s. 6d. Hand drills, $\frac{1}{4}$″ chucks, 10s. Hand grinders 6″ × 1″ wheel, 25s. Machine vice, 18s. 6d. Heavy table vice, $2\frac{1}{2}$″ jaw, 13s. 6d. Vanadium twist drills, 17 different, $\frac{1}{16}$″ to $\frac{5}{16}$″, 13s. Tin snips Universal 11″, 14s. Expanding bits, drill wood, $\frac{1}{2}$″-$1\frac{1}{2}$″, 14s., $\frac{7}{8}$″-3″, 19s. Stillson wrenches, 6″, 4s. 6d., 8″, 6s., 10″, 7s. 6d. Carpenter's braces, ratchet, 10″ sweep, 14s. Taps 40 t.p.i., 5/32″, $\frac{3}{16}$″, 7/32″, $\frac{1}{4}$″, 1s. 9d. each. B.A. 0-1-2-3-4-5-6, 1s. 2d. each, 7-8, 1s. 4d., 9-10, 1s. 9d. Dies $\frac{13}{16}$″ dia. 40 t.p.i., 5/32″, $\frac{3}{16}$″, 7/32″, $\frac{1}{4}$″, 2s. 9d. each. B.A. 0-1-2-3-4-5-6, 2s. 5d., 7-8, 3s., 9-10, 3s. 7d. each. Independent chucks, Burnerd, $3\frac{1}{4}$″, 67s. 6d., 4″, 72s., $4\frac{1}{2}$″, 75s. Precision drill chucks, $\frac{1}{2}$″, No. 1 M.T., 43s. 6d., No. 2, 44s. Drill stands 1-60, $\frac{1}{16}$″-$\frac{1}{2}$″, A-Z, 3s. 9d. each. H.S. centre drills, size 1, 2s., 2, 2s. 3d., 3, 2s. 9d., 4, 3s. Vanadium twist drills, 29 different, $\frac{1}{16}$″-$\frac{1}{2}$″, 48s. Wood chisels set $\frac{1}{4}$″, $\frac{3}{8}$″, $\frac{1}{2}$″, $\frac{5}{8}$″, 1″, 16s. Overseas orders supplied.—S. GRIMSHAW, 7, Hall Street, Manchester, 18.

**Vernier Caliper,** gauge 10″ N.S.F., unused, £6 10s.—MIDGLEY, "Richmond," Hebden Road, Haworth, Keighley.

**Illuminated Lens.** A magnifying eye-glass complete with self contained lighting unit and pocket battery. Invaluable to craftsmen for inspection, vernier reading and fine work. Money refunded if not instantly delighted, 17s. 6d. complete.—R. F. PRODUX, Marlbrough Road, Woking, Surrey.

**Compressors for Sale.** Two pistons complete with air receiver, driving wheel and motor cradle. 180 lb., 2½ cu. ft., price £3. Motors a.c. and d.c. all types ¼ h.p., £3. Carriage forward.—WHEELHOUSE, 13, Bell Road, Hounslow. 'Phone: Hounslow 8749.

**Plastics Fabricated to Order.** Singles or quantity. We supply fibre glass and resins, Perspex, P.V.C., Tufnol. S.A.E.—PLASTIC SERVICES LTD., 16, Gloucester Road, Brighton.

**Air Compressors,** tanks and accessories at far below list from £5 17s. 6d., TV and lighting generators from £15.—TEDDINGTON ENGINEERING CO. LTD., 29-31, High Street, Teddington, Middx. Tel.: Kingston 1193.

**Guaranteed! Easy Home-Constructed Refrigeration.** Genuine domestic components. Not secondhand ice cream scrap. Modern hermetic G.E.C. units, gas, electric and oil silent unit. Everything for refrigeration. Complete specialists. Send s.a.e. for free illustrated "Sealed system" leaflet or 1s. for complete catalogue (refunded with first order).—BRAID BROS, 50, Birchwood Avenue, Hackbridge, Surrey. 'Phone: Wallington 9309.

**Bright and Black** mild steel and brass. Over 170 sections in stock. S.A.E. for list.—B. J. HARRIS, The Cottage, Corngreaves Hall, Cradley Heath, Staffs.

**Watches,** any make repaired (with guarantee) post confidently to—YOUNG & SON, 133, London Road, Chippenham, Wilts.

**Winter's Here!**

**STEEL plus DAMP = RUST**

**STEEL plus OXYNIL = NO RUST**

***Spray with OXYNIL***

The Scientific Invisible Anti-Rust

Tools bright: No cleaning needed

½ pint Tin and Spray 10s. 6d. post free

*Sole Agent:* **H. GIBSON, Church Lane, Gt. Hallingbury, Bps. Stortford, Herts**

**Aqualung and Compressor** equipment ballraces and miscellaneous items. Lists 2d.—PRYCE, 157, Malden Road, Cheam.

**Learn It As You Do It**—we provide practical equipment combined with instruction in radio, television, electricity, mechanics, chemistry, photography, etc. Write for full details to—E.M.I. Institutes, Dept. ME47, London, W.4.

**Wanted. Stuart Gas Engine** about ½ h.p. State where can be seen, London area.—NICHOLLS, 12, Downhurst Avenue, Mill Hill, London, N.W.7.

**Wanted.** Finished flywheel 6" dia., 6 straight spokes, 1" flat rim ½" thick, ½" hole in boss or near.—449, Redditch Road, Kings Norton, Birmingham.

**M.E.s Wanted.** 2344, 2366, 2380, 2519, 2615, 2701—WASTELL, 147, High Street, Lowestoft.

**High Speed Steel,** hand reamers, set of six 23/32", ⅝", 19/32", 15/32", 29/64", 13/32", 21s., 1s. 4d. c.o.d. Jones and Shipman regular tungsten hacksaw blades, 12", 10s. 9d. ½ gross or 35s. gross, plus postage.—ADAMS, 6, Alders Road, Edgware, Middx.

**Juliet Chassis,** slip eccentrics. Complete except for cylinders but castings available also chimney smokebox, etc., and copper plate tubes and castings for boiler. All motion work and bearing surfaces rhodium plated for wear and all other working surfaces pure tin-plated for protection and appearance. First reasonable offer secures.—MITCHELL, 64, High View Road, Guildford.

**1 h.p. Gas Engine,** mag. ign., tank, base, running, £5. Vertical boiler parts, copper, 17" × 10", £3. S.A.E., good leather belt 14' × 1½", 15s. C./shaft, 2' long, 1" dia., f. & l. pulleys, 9½" dia., s/aligning, unused, £1. C./shaft approx. 8' × 1" dia., b./bearing, two 9" f. & l. pulleys, 25s.—GATES, 3, Railway Terrace, Alton, Hants.

**"Model Engineers" Unbound,** vols. 92 to 112, 6s. per vol. Particulars, stamp.—WALLACE, "Kentarn," Cragg Drive, Grange-o-Sands, Lancs.

**Autox.** 24 P.O.-type relays, two uni-selectors, 70 pairs of contacts from dismantled relays for shutter control contacts. Offers or exchange for anything steam driven. M.E. deposit system willingly.—Box No. 8398, MODEL ENGINEER Offices.

**Precision Engineers.** Want ideas, patents bought.—Box No. 8399, MODEL ENGINEER Offices.

**M.E.s Vols.** 104, 105, 106, vol. 107 incomplete. Many odd copies, 37s. 6d, carr. paid.—J. G. WAKEFIELD, Sturden Court, Hambrook, Bristol.

**Wanted. Heavy Type Marine** clockwork motor suitable driving propeller, 3' model boat.—ELLIOTT, 5, Bittoms Court, Kingston-on-Thames.

## WE SPECIALISE

IN EVERYTHING FOR THE MODEL ENGINEER

**Myford, Zyto, EW Lathes from stock**

Plans, materials, tools, electric motors, etc.

"Caley" universal cutting oil 2/-. Post 1/-.

"Caley" super steam oil 2/-. Post 1/-.

"Caley" steam packing 1/16 rnd. 1½d. foot. ⅛ rnd. 3d. ⅛ square 7d. foot.

**PATTERNMAKING CASTING MACHINING**

NO CATALOGUE MEANTIME S.A.E. ENQUIRIES

**CALEDONIA MODEL Co.**

5 PITT STREET GLASGOW C.2

*Corner of 468 Argyle Street*


## 7,000 EX-ADMIRALTY STOP WATCHES

**55/- each POST FREE**

**Swiss made to exacting Government specification. Jewelled lever movement. 1/5th second escapement, recording to 30 minutes. Start and stop with slide. Fly back by winding-button. Immediate restart action by winding-button when side slide is at start position. Every watch fully guaranteed. Cost price approximately £7.**

## CHARLES FRANK

**67-73 SALTMARKET, GLASGOW, C.1**

*'Phone Bell 2106/7* *Established 1907*

*Britain's largest stockists of ex-Government binoculars and scientific equipment. Send for free catalogue.*

## —"PERIOD" MODELS—

**HISTORICAL ENGINES TO A REDUCED SCALE**

Designs based on original examples, or by, Research into records.

Designed and Drawn to a uniform scale of 1 in. = 1 ft. 0 in., illustrating the comparative sizes of the originals.

By G. K. KING, A.M.I.C.E., A.M.I.Mech.E.

DRAWINGS comprise Elevations, Sections, completely dimensioned details.

CASTINGS available, also Materials, Tools.

(1) "The Fieldhouse Engine," an early curious example of a horizontal engine.

(2) A Crank Overhead Engine, 10 h.p., by B. HICK & SON, of Bolton.

(3) An Oscillating Engine, 2 h.p., by the same makers. Both exhibited at "The Great Exhibition" of 1851.

*Further models to this series in preparation*

**Historical research undertaken and drawings prepared**

*Print showing elevations, also full information, from (enclose 2½d. stamp)*

**PRECISION MODELS Co**

**BUTTS ROAD, WOKING, SURREY**

"No Quantity Too Small"

**BRASS, COPPER, BRONZE, ALUMINIUM, LIGHT ALLOYS**

*IN*

Rod, Bar, Sheet, Tube, Strip, Wire, Angle, Channel, Tee.

## H. ROLLET & CO. LTD.

**6, Chesham Place, London, S.W.1**

*SLOane 3463*

*Works:*

**32-36, Rosebery Avenue, London, E.C.1**

*BRANCHES AT*

**Liverpool Manchester Birmingham Leeds**

Printed in Great Britain for the Proprietors by ELECTRICAL PRESS LTD., Cordwallis Works, Maidenhead, Berks, and published by PERCIVAL MARSHALL & Co. LTD., 19-20, Noel Street, London, W.1. Registered for transmission by Magazine Post to Canada including Newfoundland.

**M.E. QUERY COUPON**
**FEBRUARY 1957**


# Planning Your Summer Holiday?

FORTNIGHT HOLIDAY GUIDE BOOKS will help. You will want to weigh up the merits of different holiday centres before making arrangements and reserving accommodation. These guidebooks give you up-to-date and completely impartial information about the places concerned. There are 36 titles. New books just published are: Bavaria, Holland, Portugal and Provence. The Continental titles advise you on climate, local customs, living standards, types of hotel accommodation and prices, and give useful help as to preparations for your visit, essentials to take, etc. Each title is in handy pocket or handbag size and is illustrated with photo plates.

**THE THREE AND SIX LIST** :

Devon, East Coast, Firth of Clyde, The Grand Tour, North Wales, Wye Valley, Yorkshire Coast, Not Sixty Miles from London.

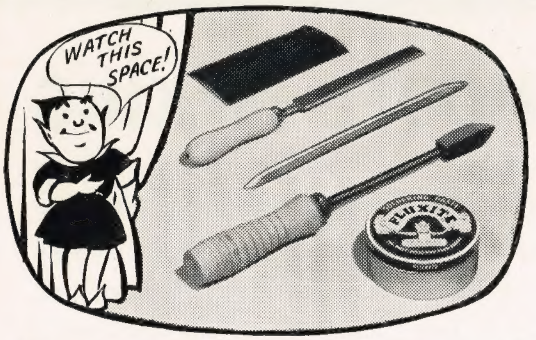
**THE FIVE SHILLING LIST** :

Austria, Bay of Naples, Balearics, Bavaria, Belgium, Black Forest, Brittany, Channel Islands, Cornwall, Costa Brava, Denmark, French Riviera, Holland, Italian Lakes, Italian Riviera, Killarney, Loire Valley, Madeira, Norway, Paris, Portugal, Provence, Rhineland, Rome, Spain, Switzerland, Tuscany and Umbria, Yugoslavia.

**Published by Percival Marshall & Co. Ltd., 19-20, Noel Street, W.1.** *If you order direct, please add 3d. per copy for postage.*

---

*Follow the* **FLUXITE** *way to Easy Soldering*




**No. I.** ***Choosing the right materials***
**is the first and most important step towards successful soldering. Briefly—a medium size soldering iron, a stick of solder, a file, emery cloth and a tin of FLUXITE.**

FLUXITE is the household word for a flux that is famous throughout the world for its absolute reliability. In factory, workshop and in the home FLUXITE has become indispensable. It has no equal. It has been the choice of Government works, leading manufacturers; engineers and mechanics for over 40 years.

**FLUXITE**
**SIMPLIFIES *ALL* SOLDERING**

**Fluxite Limited, Bermondsey Street, London, S.E.1**

H.I

---

* Permanent Magnets in action *

*Ever dropped a nut in a gearbox?*

In case you do, have an 'Eclipse' Pot Magnet available to help you recover the nut.
This is one of many ways in which magnets can help you.
*Ask your tool dealer for descriptive literature.*

**Eclipse PERMANENT MAGNETS**

Made by James Neill & Company (Sheffield) Limited
*and obtainable from all tool distributors*

FM42